AUGUST 23, 1954

Electrical World

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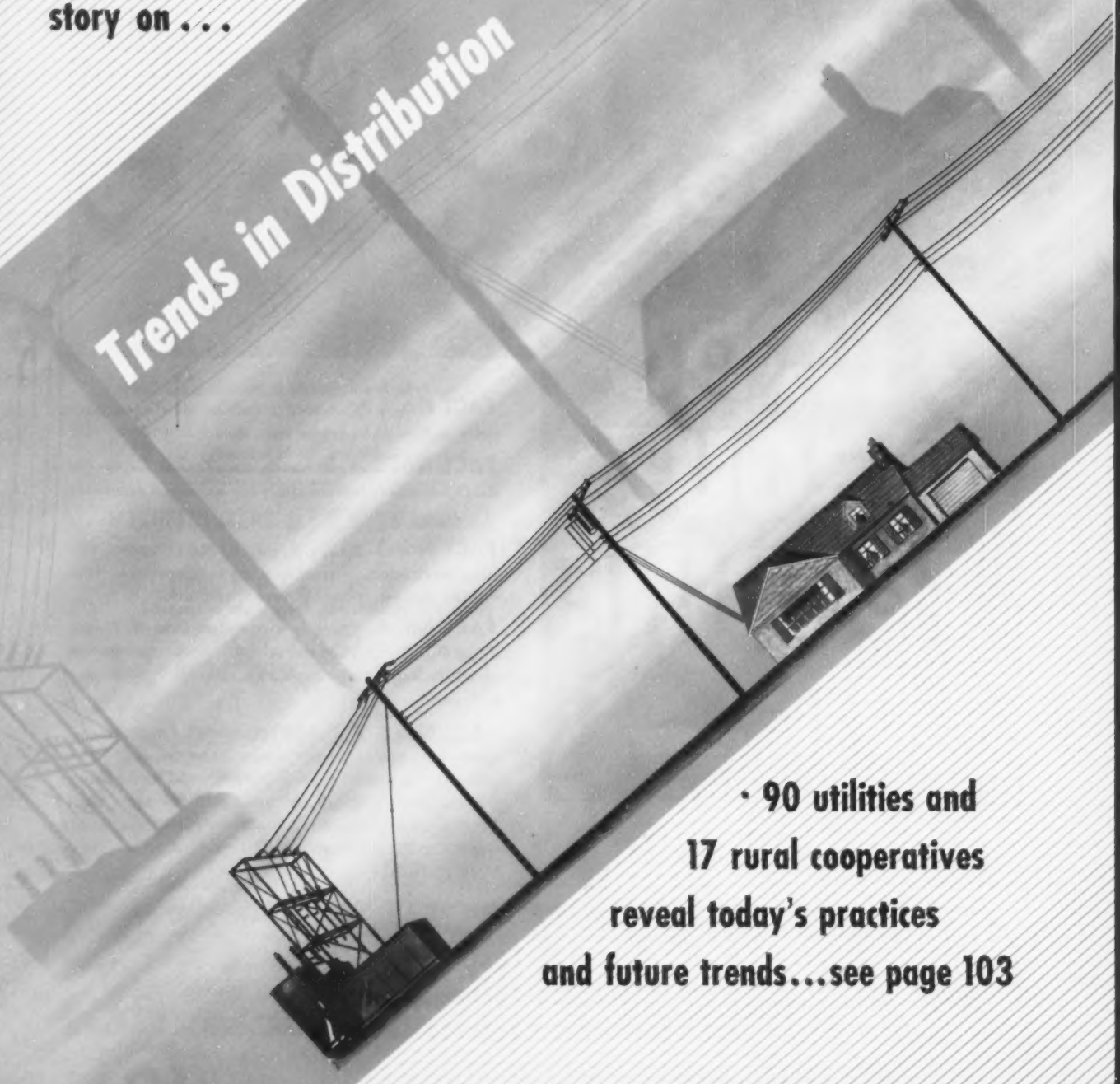

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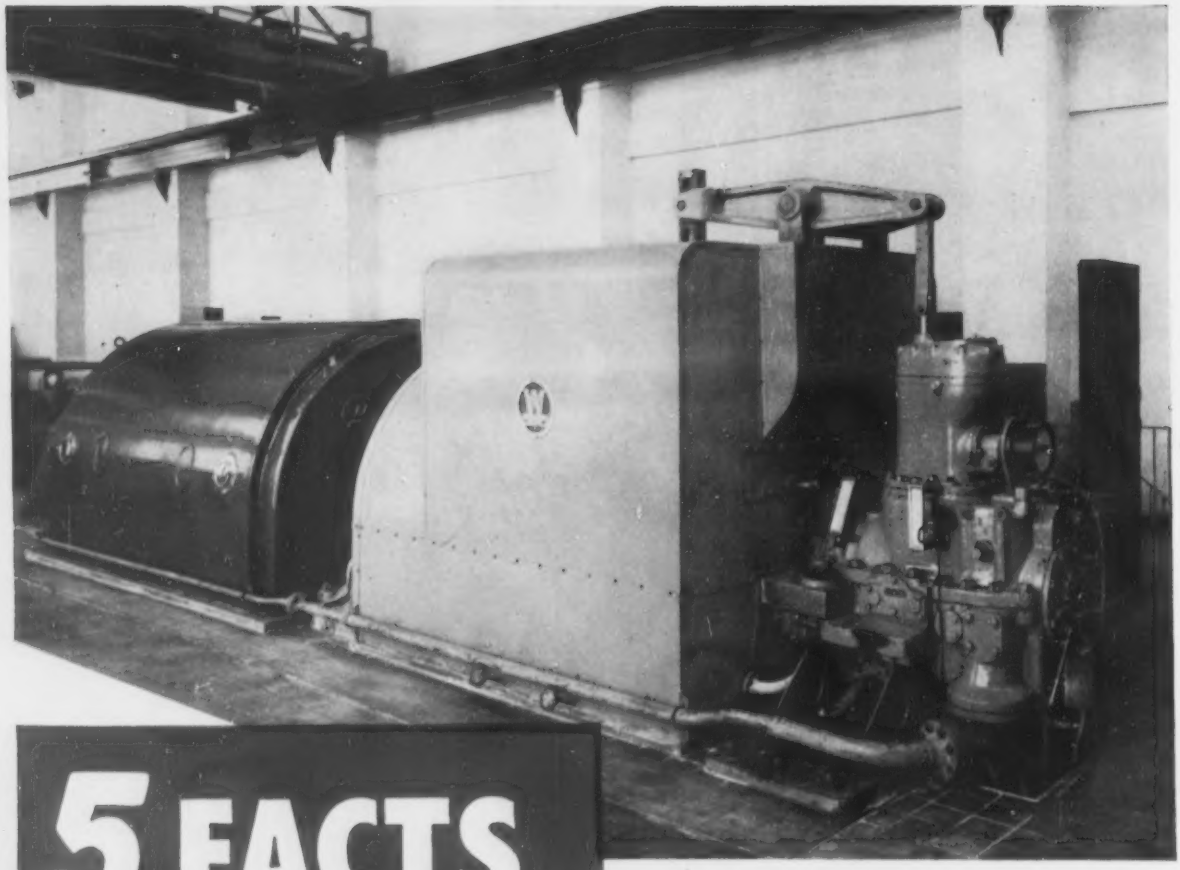

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FACT No. 1—You need a turbine oil that is especially designed to prevent rust, sludge and foam.

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TEXACO Regal Oils R&O

FOR ALL TURBINES

Electrical World

Vol. 142 No. 8 August 23, 1954

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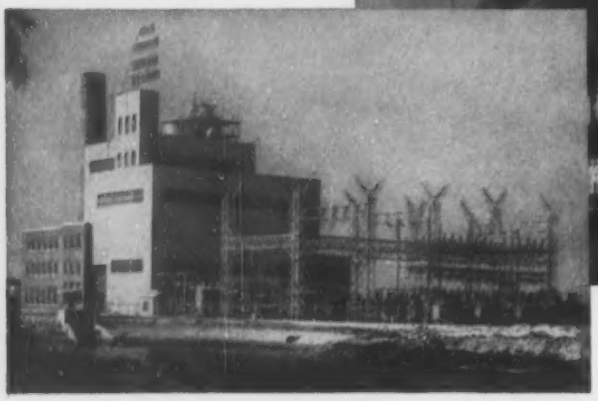
Published weekly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. Publication Office, 99-129 N. Broadway, Albany 1, N. Y. Executive, Editorial and Advertising Office, McGraw-Hill Building, 330 W. 42nd St., New York 36, N. Y. Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Executive Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Subscriptions: Address correspondence to Electrical World — Subscription Service, 99-129 North Broadway, Albany 1, N. Y. or 330 W. 42nd St., New York 36, N. Y. Allow one month for change of address.

Subscriptions are accepted only from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields. Position and company connection must be indicated on subscription orders.

Single copies 35¢. For the United States and possessions $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money, at par.) Other Western Hemisphere, and the Philippines, $15 for one year, $25 for two years, $30 for three years. All other countries $25 for one year, $40 for two years, $50 for three years. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U.S.A. Copyright 1954, by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents.

Plant Yates (right) located at Whitesburg, Georgia, has a rated output of 300,000 kw. Plant McManus, at Brunswick, is rated at 40,000 kw. Southern Services, Inc. were the consulting and design engineers for the plants.



OKOLITE-OKOPRENE cables control 340,000 kw for two Georgia Power Company plants

The 30-year installation record of Okolite insulation and the service-proved record of the Okoprene sheath against moisture, heat, ozone, abrasion, oil, acids and weather extremes are the foremost reasons why Okolite-Okoprene cables are chosen by public utilities throughout the nation.

Plant Yates and Plant McManus are two of the typically fine properties of the Georgia Power Company. Plant Yates, named for Eugene Adams Yates, a pioneer figure in the electrical industry and Chairman of the Board of The Southern Company, is Georgia's largest and most modern steam-electric generating plant. The recently completed Plant McManus, named for C. B. McManus, President of The Southern Company, is another excellent example of a modern steam-electric station. Both plants are completely wired with Okolite-Okoprene. All d-c and a-c control cables are Okolite-Okoprene. Metering and relay wiring utilizes Okolite-Okoprene multi-conductor control cables. Single-conductor 600-volt and 5,000-volt Okolite-Okoprene auxiliary cables carry all a-c power.

For full information on Okolite-Okoprene, the oil base, natural rubber-insulated cable that is cured in a continuous metal mold, write for Bulletin EW 1053B. The Okonite Company, Passaic, N. J.

OKONITE SINCE 1878 *insulated cables*

2415

HOT-LINE TOOLS

and SAFETY ACCESSORIES

...via GraybaR

Your linemen are only as safe as their equipment—lives depend on its quality.

So, for sure, certain all-over protection order hot-line and safety needs from your near-by Graybar office. Made by well-known, highly-regarded manufacturers, they're all products your linemen respect . . . work with in confidence.

Chance hot-line tools — Graybar can supply Chance hot-line maintenance tools individually or in sets. Incorporating the latest developments in equipment for handling energized lines, Chance tools are tested to withstand 75,000 volts per foot. Metal fittings are lightweight, heat-treated aluminum alloy...poles are laminated Sitka Spruce. There's a specialized Chance tool designed to do every hot-line job safely and efficiently.

Salisbury Rubber safety accessories — Graybar distributes Salisbury protective devices of all types — rubber line hose and insulator hoods . . . rubber blankets and jackets . . . rubber coats, gloves, and sleeves. All are top-quality fully-guaranteed products made of purest crude rubber.

Call Graybar for all of your other pole-line needs as well. You can rely on your local Graybar Representative to provide complete, accurate information on anything you require. For special help on out-of-the ordinary problems, feel free to ask for the assistance of a Graybar Outside Construction Specialist. *Graybar Electric Co., Inc. Executive Offices: Graybar Building, 420 Lexington Avenue, New York 17, N. Y.*

347-98

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Everything Electrical

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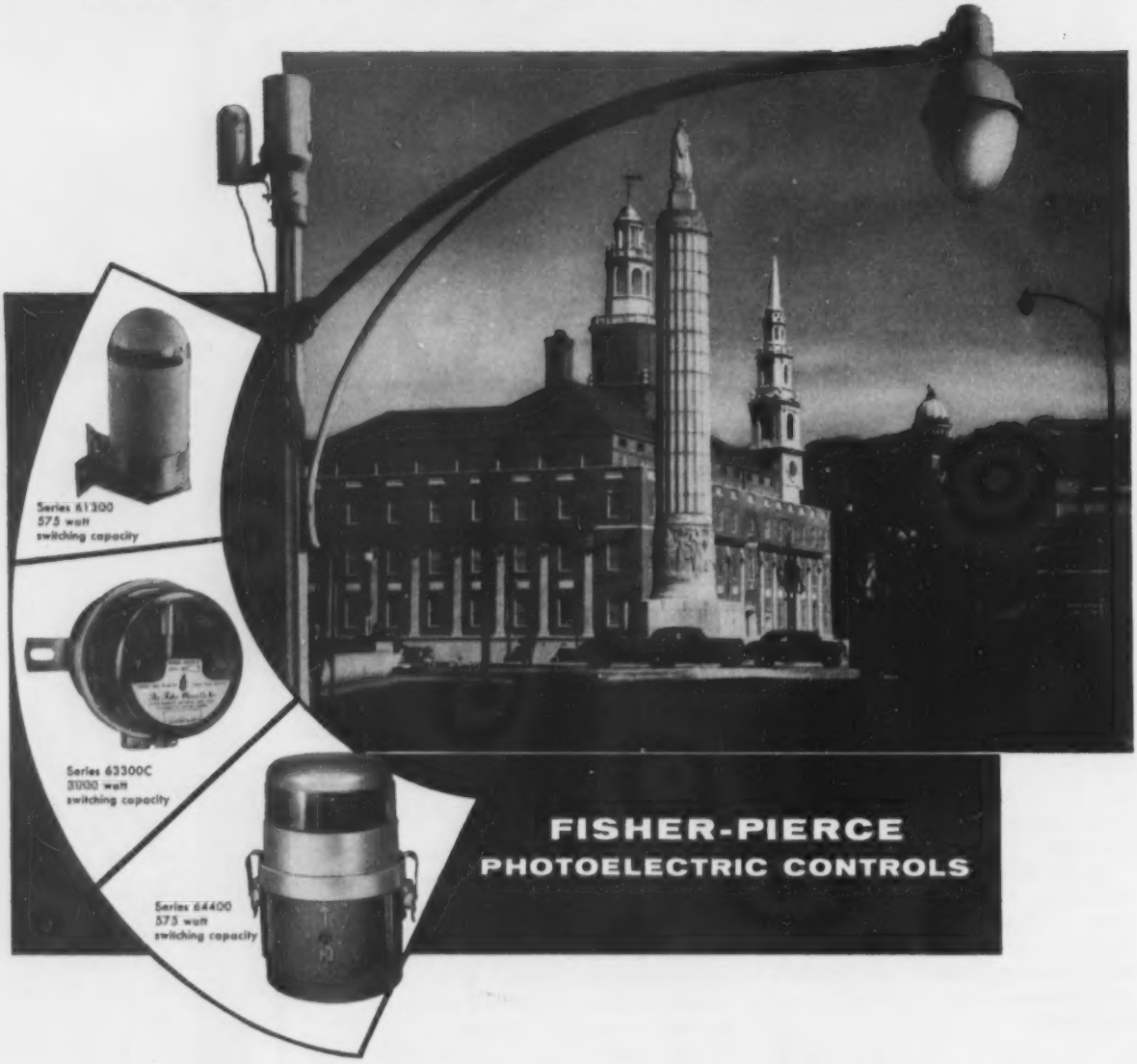
IN OVER 110 PRINCIPAL CITIES

CONTROLLING STREET LIGHTS IN PROVIDENCE, R. I.

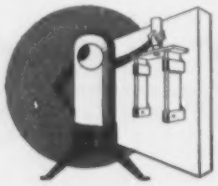


Motorists and pedestrians in Providence can thank their City Government for authorizing The Narragansett Electric Company to install dependable, automatically controlled street illumination.

The use of Fisher-Pierce street lighting controls assures dependable *automatic* illumination of streets the moment daylight drops below a safe value. Because F-P controls are photoelectric, they operate regardless of the hour, the season or the weather.

On the job in Providence since 1946, F-P controls now number about 3000. Narragansett engineers report favorable installation economics *and* an extremely low failure rate — only 2.29% of *all* units during a recent 12-month period.

Long, dependable service of F-P controls — in street lighting control systems in Providence and hundreds of *other* communities — is the basic reason Fisher-Pierce is recognized as a *leader* in its field.



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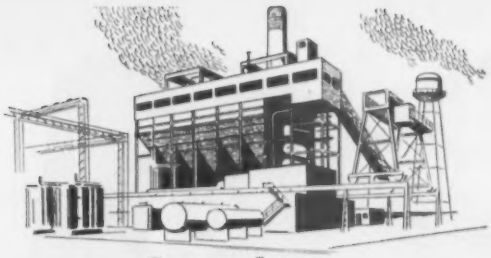
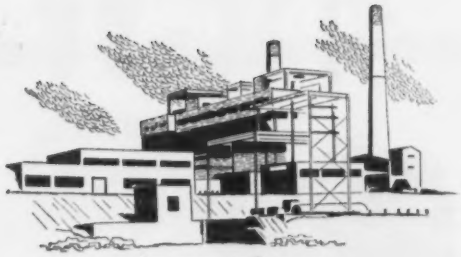
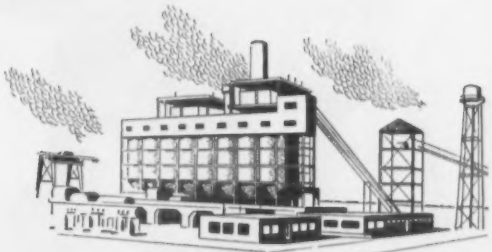


GOLDSBORO STATION
Total capability 169,000 kw.



LUMBERTON STATION
Total capability 185,000 kw.



WILMINGTON STATION
Total capability 230,000 kw. (est.)

Grinnell piping products have played a vital role in the construction of

7 NEW UNITS IN 7 YEARS

for Carolina Power & Light Company

HERE IS THE RECORD!
(Completion dates)
1949 . . . Lumberton Station, Unit #1
1950 . . . Lumberton Station, Unit #2
1951 . . . Goldsboro Station, Unit #2
1952 . . . Goldsboro Station, Unit #1
1952 . . . Lumberton Station, Unit #3
1954 . . . Wilmington Station, Unit #1
(Scheduled completion date)
1955 . . . Wilmington Station, Unit #2

Main steam line in WILMINGTON plant, fabricated by Grinnell, and supported by Grinnell Model R Constant-Support Hangers.

Since 1949, Carolina Power & Light's modernization and improvement program has been in full swing. Over this 6-year period, 6 new steam-electric generating units have been added to the system, with another scheduled for completion early in 1955. And very significantly, in each of these seven new units, Grinnell Prefabricated Piping and Grinnell Engineered Hangers have been employed, *exclusively!*

This continuous use of Grinnell Piping Products over the years means that Grinnell has successfully passed the most exacting test of all . . . the "test" of actual performance . . . on the job . . . day-in and day-out.

Piping fabricated in Grinnell shops is done under ideal conditions, with modern equipment, by personnel qualified for each class of work. Included in the price (which is determined in advance) are such items of expense as: interpretive engineering, shop sketches and planning, procurement of materials, power services, expendable tools and supplies. There are no charges for waste material or spoilage. All piping is rigidly inspected and tested to comply exactly with customer specifications and applicable codes. Consult Grinnell on your next piping job.

GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

new_

Developed to provide fast arc interruption on both high current faults and low current switching

The interrupting unit consists of the familiar *Turbo Ruptor* device supplemented by an oil jet arrangement. The contact structure combines a tulip type stationary contact with a bayonet and a high speed sickle contact.

This device has been tested from line switching values to 10,000,000 kva in combination of field and laboratory tests. It is but one feature of the outstanding BZO line of breakers — the line that also offers mechanically trip-free pneumatic or *Pneu-Draulic* operating mechanisms, and complete assembly and mechanical testing prior to shipment.

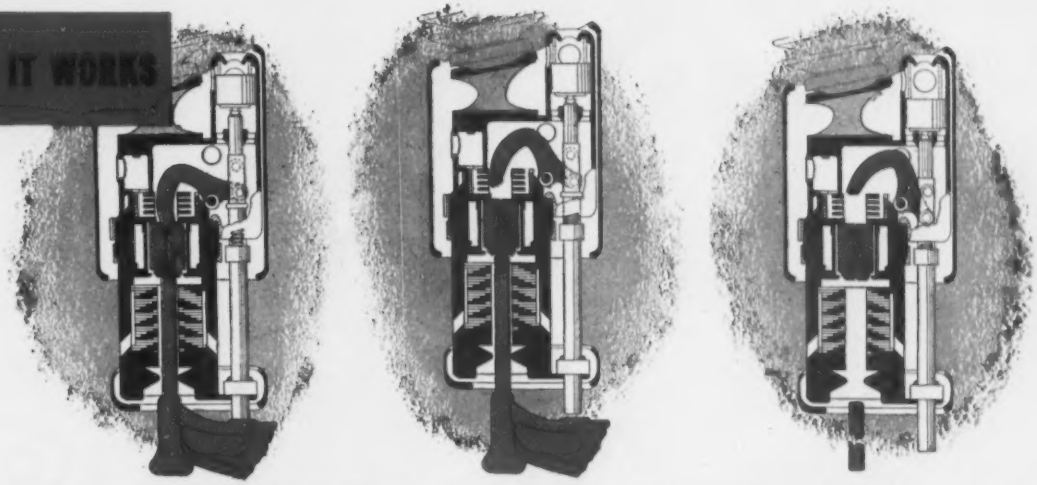
For complete information on the BZO breaker, call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4347

Turbo Jet, Turbo Ruptor, Pneu-Draulic and Ruptor are Allis-Chalmers trademarks.

ALLIS-

"Turbo Jet" Interrupter

HOW IT WORKS

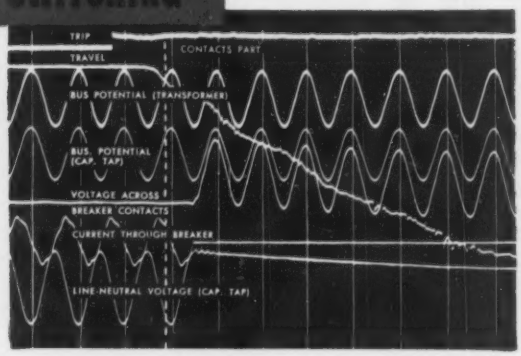


CLOSING — As cross-head and bayonet move upward to close, pushrod is forced upward to charge oil jet activator, and close upper contact. Simultaneously, piston permits oil to pass into upper chamber through a disc valve. Upper and lower movable contacts make contact with stationary element and breaker is closed.

OPENING — Cross-head is driven downward by accelerating spring. Upper contact opens and activator forces oil jet through laminated grid across arc path. Lower contact enters helical passage drawing arc which gasifies a portion of oil, forming a gas bubble. Oil swirls against lower portion of arc and disrupts it.

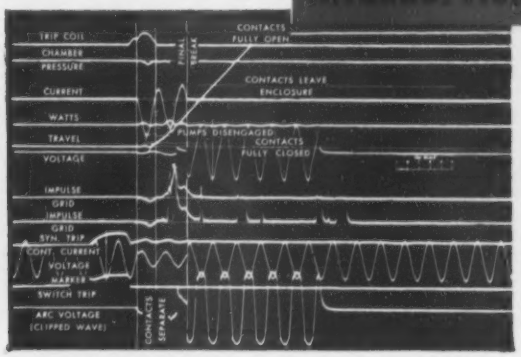
The increasing bubble pressure in lower chambers forces dielectrically unimpaired oil to swirl through arc path, preventing reestablishment of the arc. Complete withdrawal of bayonet from throat permits high pressure gas bubble to escape. *Ruptor* chamber refills with oil through refill holes in hood.

LOW CURRENT SWITCHING



Here's 187.8 mile line dropping test. Interrupting time was 1.71 cycles. No restrike.

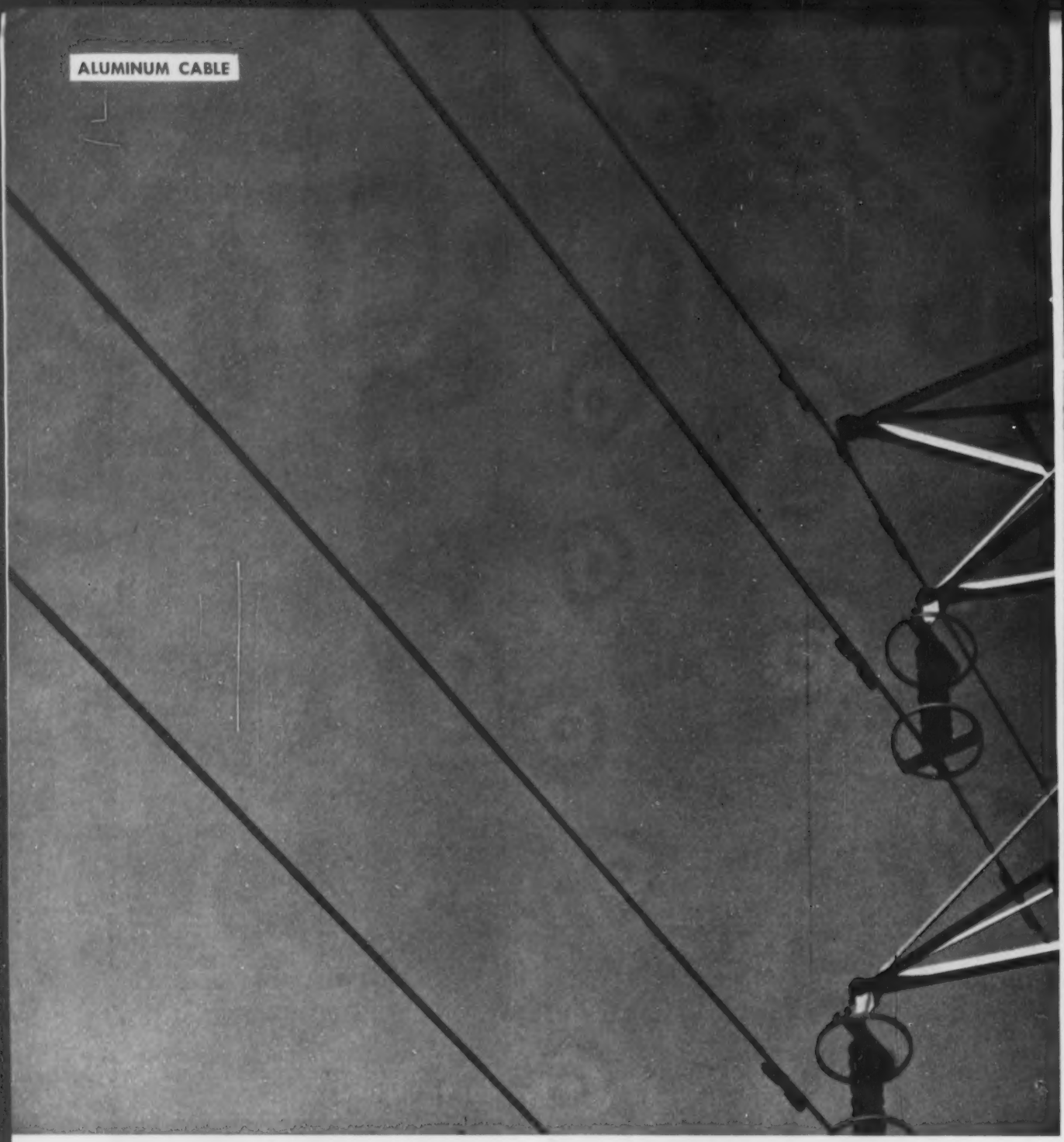
HIGH CURRENT INTERRUPTION



In this test 46,400 amperes interrupted in 2.60 cycles — 122 percent ampere rating.

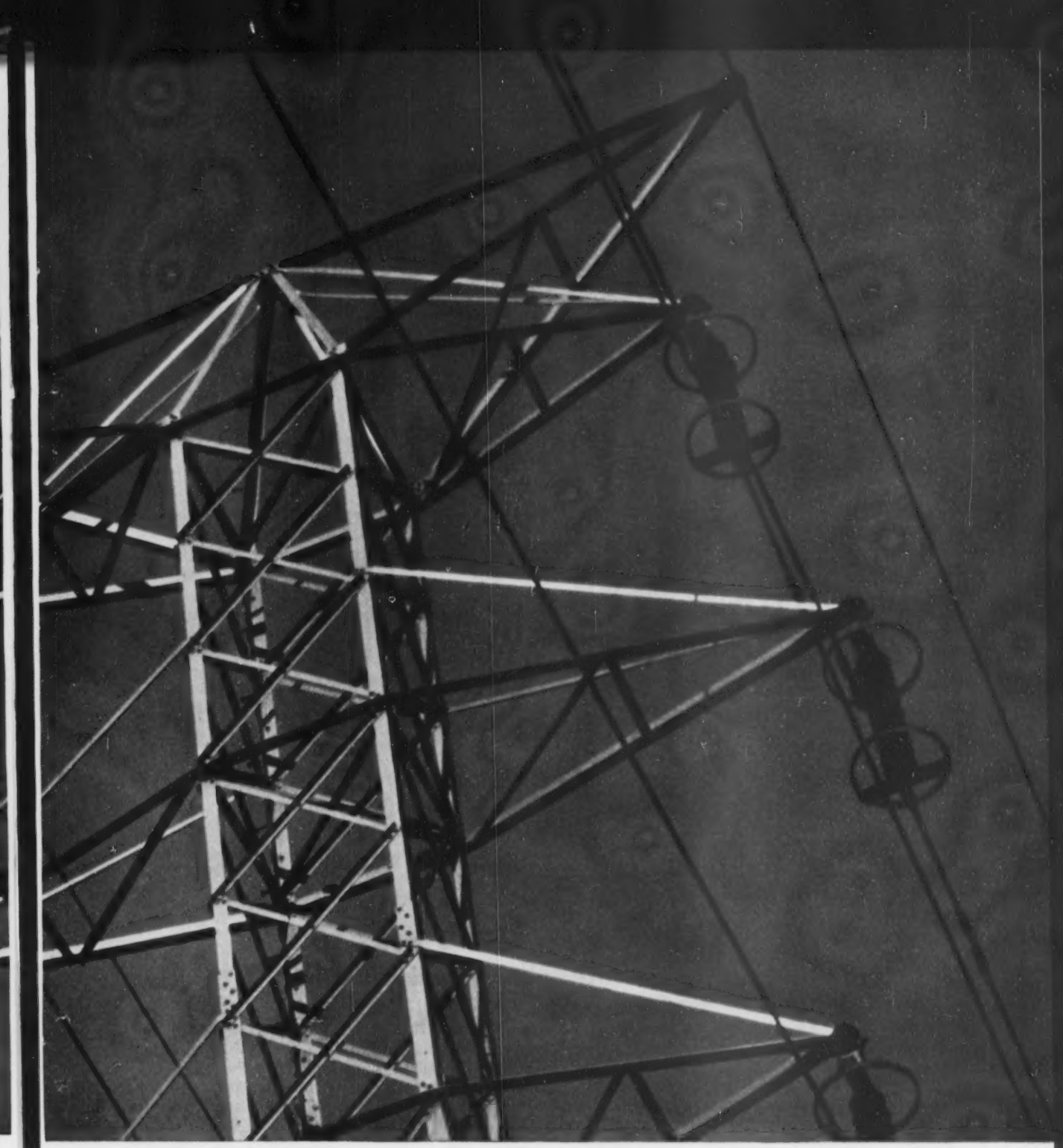
CHALMERS

A-C ALLIS-CHALMERS



Anaconda Recipe for ACSR...

Aluminum, Steel...AND CABLE EXPERIENCE



ANYONE can put Aluminum and Steel together!

But do you get what you want?

At Anaconda, we add still another prime essential – cable experience!

Not everyone has it. Cable experience takes *years* of "on the job" cable design, metallurgical research and manufacturing "know-how."

Such experience comes only from *living with* the problem.

We use this plus quality – cable experience – and the very latest equipment to make the finest cable.

And we manufacture and stock aluminum in 5 strategically located mills to assure you of quick, sure delivery. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.* 64399

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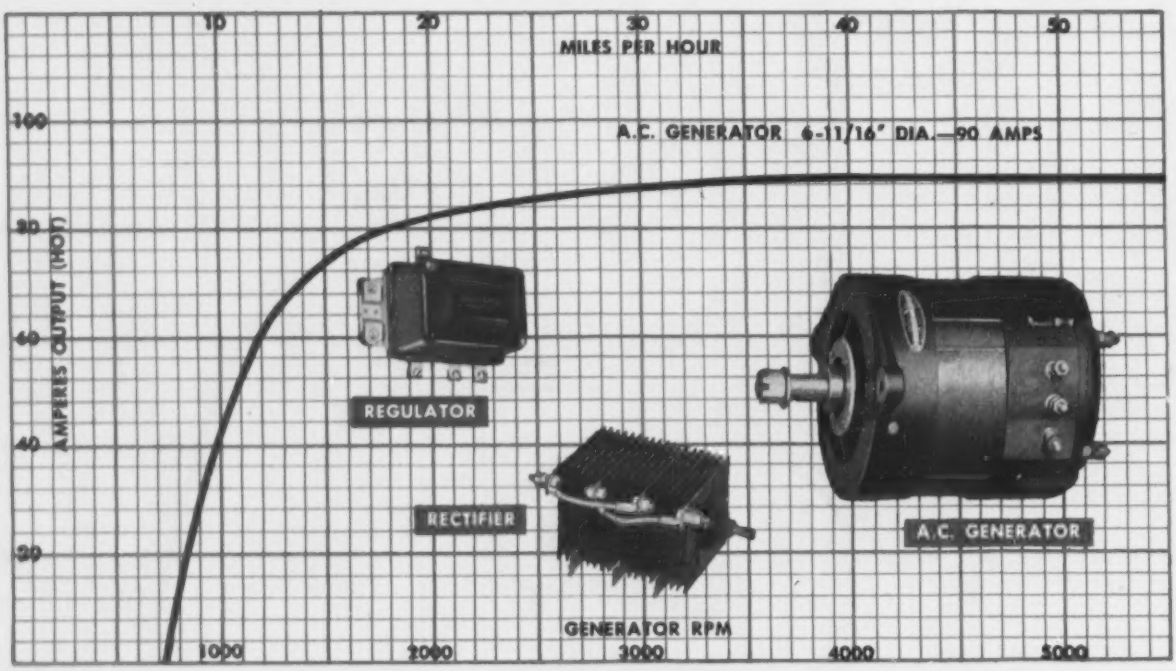
Copper and Aluminum insulated conductors • Copper and Aluminum service cable • Wire and Cable accessories • ACSR transmission and distribution • Copper, Aluminum and Copperweld bare and weatherproof wire.

Power Packed and

HERE'S THE A.C. ANSWER TO EXTRA-HEAVY ELECTRICAL DEMANDS



DELCO-REMY

A. C. Generator, Regulator and Rectifier

Here's the answer for "problem" vehicles—Delco-Remy's new long-lived A.C.-D.C. charging system! It's specifically designed to meet the *extra*-heavy electrical demands of public utility trucks and other vehicles equipped with two-way radio, floodlights or any extra electrical units . . . ample current reserve picks up discharged battery quickly in operation. Delco-Remy A.C. generators are suitable for use at all engine speeds.

With output ranging from 30-40 amperes at curb idle and up to 90 amperes at higher engine speeds, the new Delco-Remy A.C.-D.C. charging system meets all electrical needs under the toughest operating conditions. Included in the new system is the A.C. generator, a matching regulator, and a rugged, dependable dry-plate rectifier which converts generator A.C. output to direct current.

Application packages complete with installation instruction sheets for popular makes of cars and trucks are now available. The conversion job is simple. For further details and application data, see your nearest United Motors distributor.

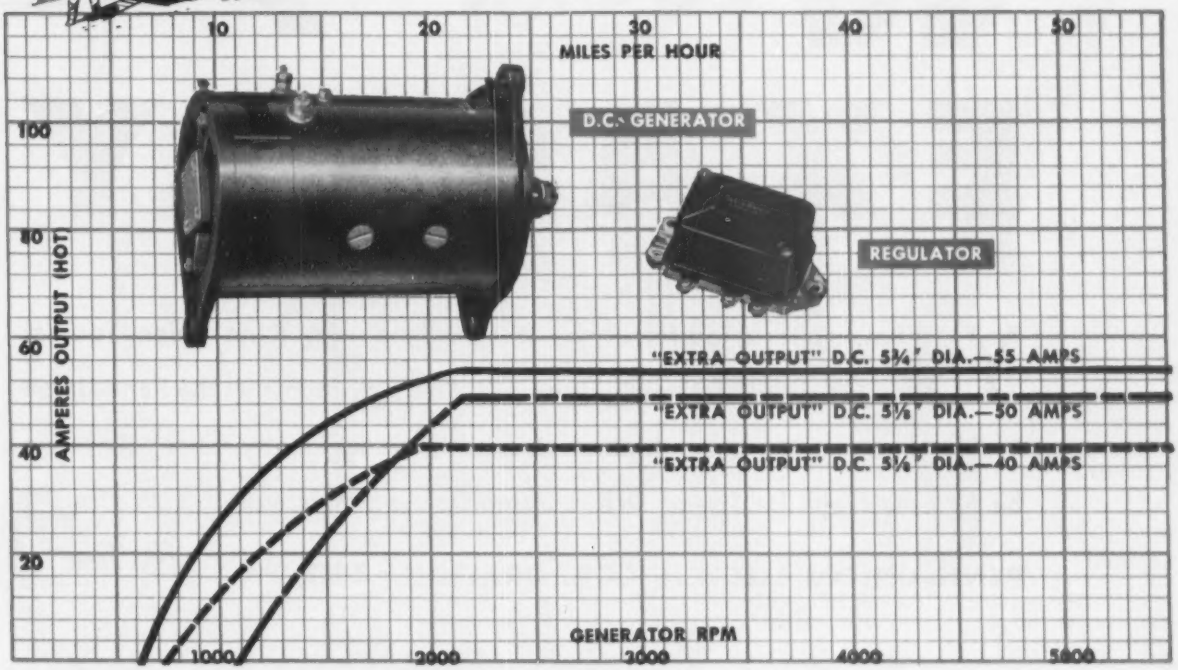
A GENERAL MOTORS PRODUCT — A UNITED MOTORS LINE

DISTRIBUTED BY WHOLESALERS EVERYWHERE

WHEREVER WHEELS TURN OR PROPELLERS SPIN

Right for the Job

HERE'S THE D.C. ANSWER TO HEAVY ELECTRICAL DEMANDS



DELCO-REMY

Extra-Output D. C. Generators and Matching Regulators

Delco-Remy extra-output D.C. generators are an economical answer to the electrical needs of public utility pickup or panel trucks as well as other vehicles with additional lights, two-way radios, or other special electrical equipment in medium to heavy-duty service. Delco-Remy extra-output D.C. generators are low in cost, simple to install, economical to maintain.

DELCO-REMY 40-AMP GENERATOR has low cut-in, about 7 mph, charges from 11 to 17 amperes at curb idle . . . full output about 18 mph —for vehicles customarily used in heavy traffic.

DELCO-REMY 50-AMP GENERATOR has slightly higher cut-in, about 11 mph . . . full output about 21 mph—for vehicles customarily operated at higher speeds, with minimum slow driving.

DELCO-REMY 55-AMP GENERATOR has very low cut-in, about 6 mph; charges at curb idle from 20 to 30 amperes . . . attains full output at 20 to 25 mph—for vehicles customarily operated at low speeds with added electrical loads, such as city taxicabs and police cars.

For further details and application data, see your nearest United Motors distributor.

Delco-Remy

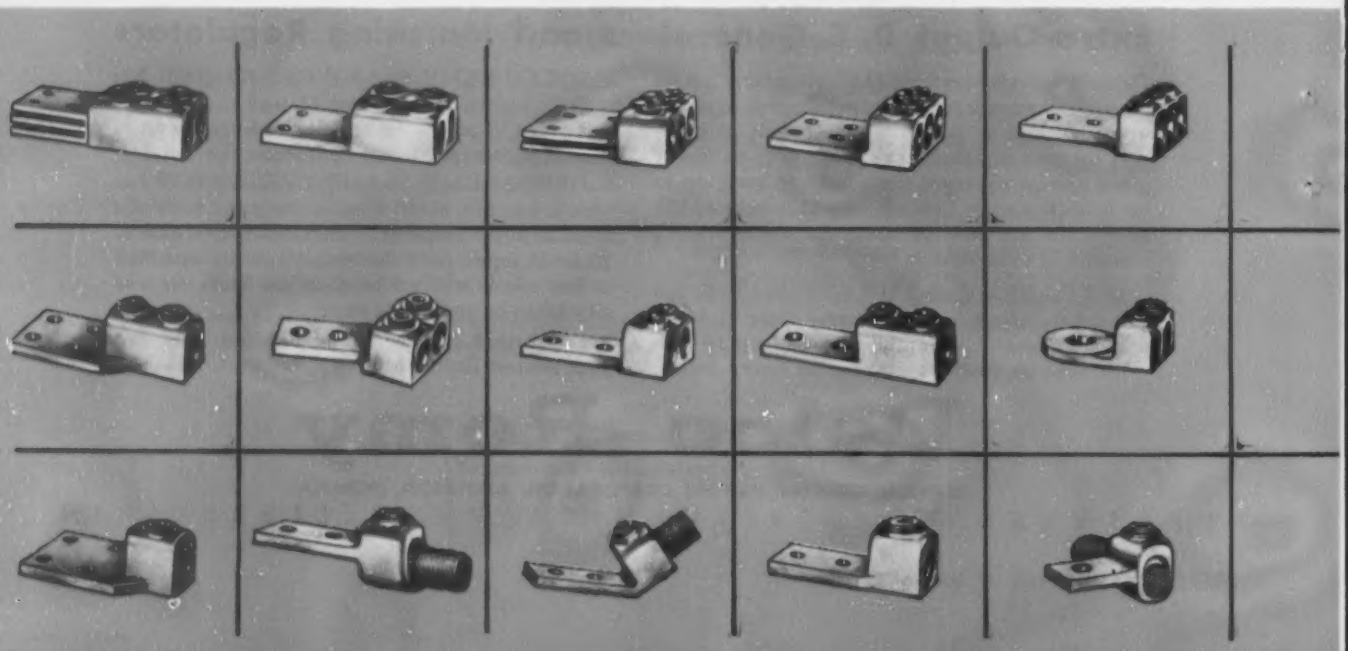
DIVISION, GENERAL MOTORS CORPORATION, ANDERSON, INDIANA

WHEREVER WHEELS TURN OR PROPELLERS SPIN

What you EXACTLY

YOU never alter a job to suit the fittings, when using Penn-Union. You get EXACTLY RIGHT fittings . . . promptly. Below are some of the Penn-Union Vi-Tite Lugs you can order from stock (and there are many more). Any can be furnished with hex-head screws instead of socket screws.

PENN-UNION ELECTRIC CORPORATION • ERIE, PA.



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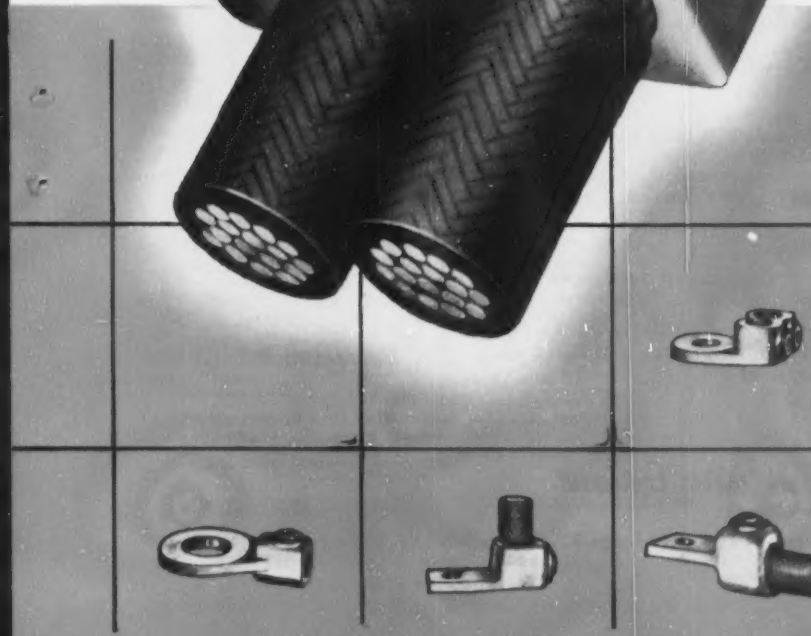

PENN-UNION

Penn-Union Electric Corporation • Erie, Pa.

Please send details of your complete line of Vi-Tite Lugs.

(Name)_____

(Company)_____

(Address)_____

"It costs us only 34¢ for every $1.00 of new revenue commercial cooking brings in!"

... Carl T. Bremicker, Vice President, In Charge of Sales, Northern States Power Co., Minneapolis, Minn.

What is new E.A.R. worth? Many utility executives often use the rule-of-thumb that says you can spend $1.00 to get $1.00. But up at the Minneapolis headquarters of Northern States Power, the records show that an all-out drive for commercial cooking load is building a *whole new business* for this great Minnesota utility—and at a cost of just 34c per new $1.00 of E.A.R.

"In 1950," points out vice president Carl T. Bremicker, "E.A.R. from commercial cooking totalled $60,000. Our determination to go after the market with trained manpower and aggressive promotion brought that figure up to over half a million dollars in 1953, and we'll pass the $1,000,000 mark by the end of 1955!"

How Can You Promote Commercial Electric Cooking In Your Territory?

Yes, a great potential exists in commercial cooking. However, maximum returns require *thorough* promotion. Here are the essentials of Northern States Power's program:

- calls and *repeat* calls on food service operations.
- display and demonstrations.
- sales contests.
- training courses for company and dealer salesmen.
- trial use of counter line equipment.
- free service for one year on equipment sold.

Results? 75% of all trial equipment was sold—for an increase of 2.85 kw per operator!

"It's surprising that the profit potential in commercial cooking needs to be advertised . . ."

J. Roscoe Furber, Gen. Sales Mgr.

"... because we know of so many utilities that have been so tremendously successful in commercial cooking promotion that we assumed it already had universal recognition as an indispensable building medium."

"Year 'round promotion makes commercial cooking big business!"

Walter E. Gilbert, Manager, Industrial Sales

"Unlike lighting, refrigeration and air conditioning, commercial cooking doesn't *have* to go electric! If we eased up on commercial cooking promotion tomorrow (which we have no intention of doing!), new revenues would soon slip back to old levels, because there is real competition for this load. Its characteristics are very nearly ideal."

"Promotion program to be enlarged, public service to be continued in 1954!"

John C. Newhouse, Supervisor, Industrial Sales

"Much of our commercial cooking market is still untapped. As a result, we intend to enlarge our promotion even further next year. And while we are adding kw's, this program helps our customers increase their profits, too! For instance, the Dutch Mill Night Club, Minot, North Dakota, replaced two competitive 110-lb. fry kettles with one 28-lb. capacity Hotpoint Mark 313 electric frying machine, at a savings of $45.00 a month in fat alone!"

YOU CAN MATCH THE NSP SAGA

The time is now. Why not share our commercial cooking services and programs? Write and I will give your letter my personal attention.

Orrin E. Wolf

Orrin E. Wolf, Vice President, Hotpoint Co.

Hotpoint ALL ELECTRIC Commercial Cooking Equipment

Hotpoint Co. A Division of General Electric Company

Commercial Equipment Department, 265 South Seeley Avenue, Chicago 12, Illinois

from design to delivery . . .

R&IE

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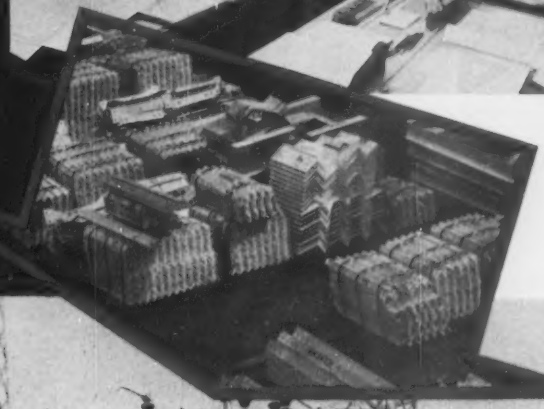
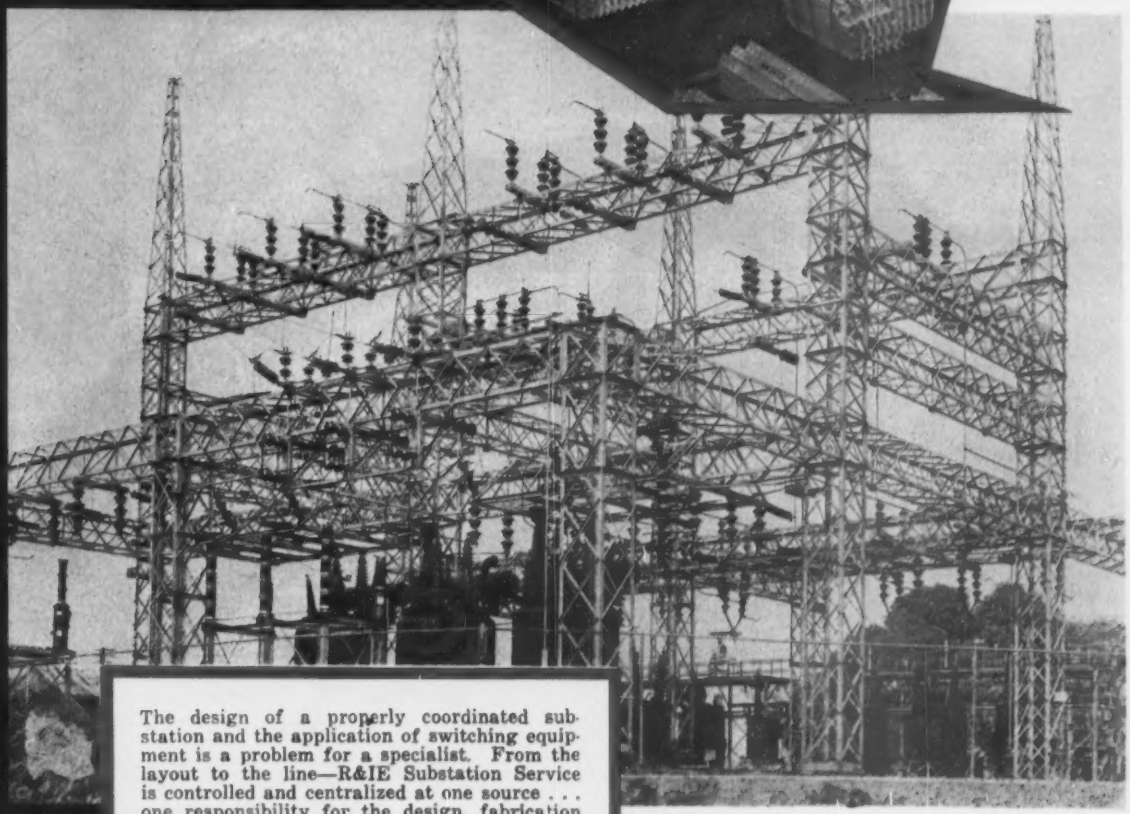
features

One Responsibility





The design of a properly coordinated substation and the application of switching equipment is a problem for a specialist. From the layout to the line—R&IE Substation Service is controlled and centralized at one source . . . one responsibility for the design, fabrication and application of Blade Switching Equipment.

R&IE know-how—the result of over forty-three years of dependable construction experience—produces a correct installation, (steel or aluminum) mechanically and electrically.

R&IE EQUIPMENT DIVISION

I-T-E CIRCUIT BREAKER CO.

GREENSBURG, PA.

STRUCTURES—steel or aluminum ● TESTING DEVICES ● KIRK KEY INTERLOCK SYSTEMS ● ISOLATED PHASE BUS STRUCTURES ● INTERRUPTER SWITCHES

INDOOR BUS SUPPORTS and BUS FABRICATION ● OUTDOOR BUS SUPPORTS and AIR SWITCHES ● SUBSTATION

Utility company in Texas successfully combats corrosion with U. S. Uscolite Pipe in 6 of its plants

All 6 plants use chlorine to control slime growth in "cooling water." One of the 6 plants (shown below, in Corpus Christi, Texas) also uses chlorine to control marine growth in sea water used exclusively for cooling. In addition, this plant uses Uscolite pipe to combat another enemy—high salt content of soil which corrodes metal pipe from outside and causes failure. These are the reasons why the utility company changed from iron pipe (which lasted only 4 years) to Uscolite® pipe, which is expected to last 30 years. Unlike other piping, Uscolite is not attacked by chlorine or most chemicals, or even sea water.

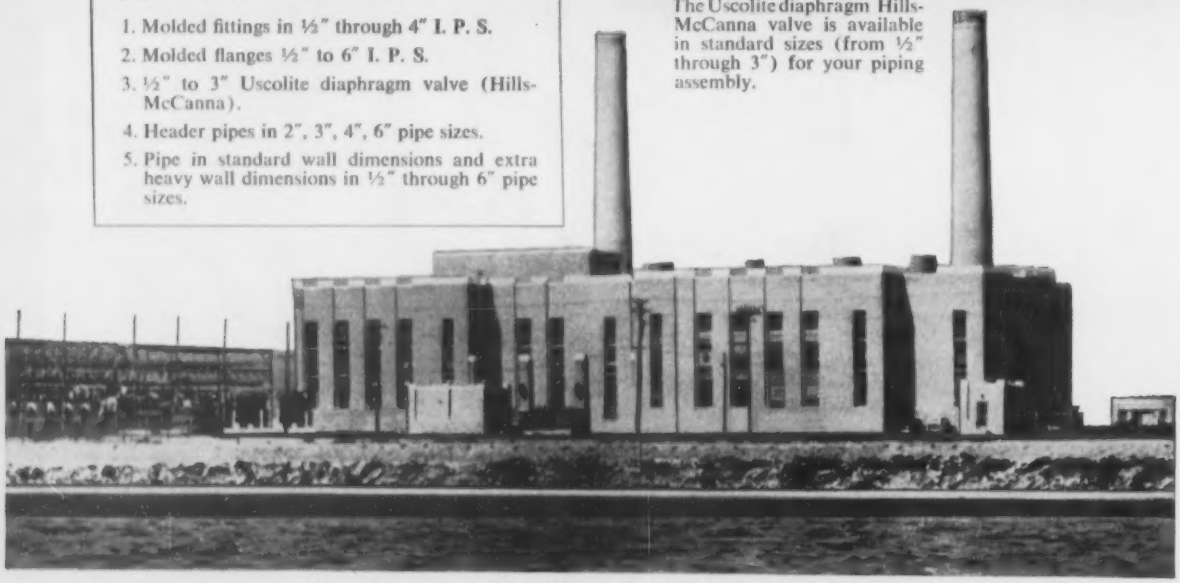
Uscolite is manufactured exclusively by United States Rubber Company. It has extremely high impact strength, high endurance, needs absolutely no maintenance, is very lightweight. It is available in standard lengths, and can be cut to length and threaded on the job.

Uscolite is the answer to corrosion and maintenance problems in piping. Any of the 27 "U.S." District Sales Offices will provide complete assistance and facts. Or get in touch with any of our selected distributors or write to address below.

Uscolite pipe and fittings come in the broadest and largest line of stock sizes of plastic pipe on the market. Sizes follow:

1. Molded fittings in ½" through 4" I. P. S.
2. Molded flanges ½" to 6" I. P. S.
3. ½" to 3" Uscolite diaphragm valve (Hills-McCanna).
4. Header pipes in 2", 3", 4", 6" pipe sizes.
5. Pipe in standard wall dimensions and extra heavy wall dimensions in ½" through 6" pipe sizes.

The Uscolite diaphragm Hills-McCanna valve is available in standard sizes (from ½" through 3") for your piping assembly.



*Above is photo of one of the plants, owned by Central Power & Light Co., Texas

US RUBBER

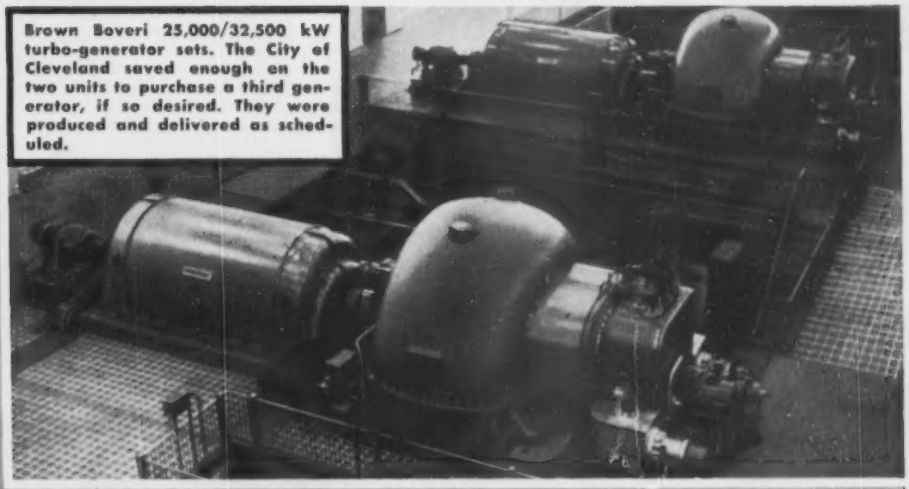
"U.S." Research perfects it..."U.S." Production builds it...U.S. Industry depends on it.

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting

men who know turbines say:



Brown Boveri 25,000/32,500 kW turbo-generator sets. The City of Cleveland saved enough on the two units to purchase a third generator, if so desired. They were produced and delivered as scheduled.

"the BEST, for LESS— BROWN BOVERI TURBO GENERATORS"

Engineers, utility and "co-op" electric officials use these 8 points to measure the practical economies of a turbo-generator:

1—TOP EFFICIENCY
2—LONG LIFE
3—MINIMUM MAINTENANCE
4—THOROUGH DEPENDABILITY
5—COMPACT DESIGN
6—LOW INITIAL COST
7—PROMPT DELIVERY
8—COMPLETE SERVICE FACILITIES

Brown Boveri Turbo-Generators incorporate all these basic advantages — plus, of course, world-famous Brown Boveri quality. Whenever you see a Brown Boveri turbine in operation, there you will find the Best . . . in trouble-free, dependable performance . . . for LESS.

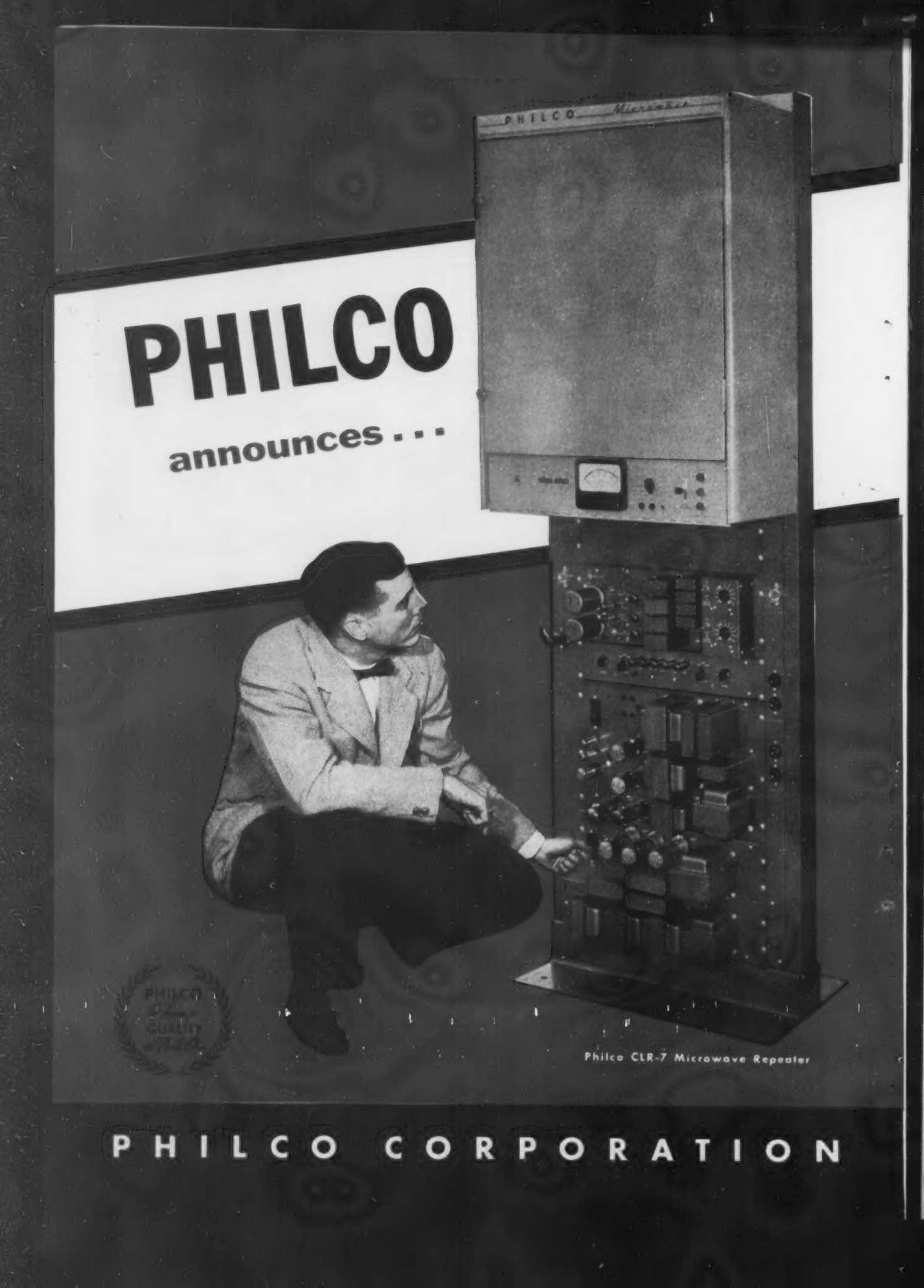
WRITE FOR DATA!

BROWN BOVERI

BROWN BOVERI CORPORATION

19 RECTOR STREET • NEW YORK 6, N. Y.

SALES OFFICES Atlanta, Ga. • Birmingham, Ala. • Boston, Mass. • Butte, Mont. • Chicago, Ill. • Cleveland, O. Denver, Colo. • Detroit, Mich. • High Point, N. C. • Jacksonville, Fla. • Kansas City, Mo. Knoxville, Tenn. • Lewiston, Me. • Los Angeles, Cal. • Minneapolis, Minn. • New Orleans, La. New York, N. Y. • Portland, Ore. • San Francisco, Cal. • Seattle, Wash. • Tucson, Ariz.


PHILCO
announces . . .
PHILCO
Philco CLR-7 Microwave Repeater
PHILCO CORPORATION

. . . a major advancement in MICROWAVE COMMUNICATIONS

with the new PHILCO CLR-7

Here it is—the new PHILCO CLR-7 . . . with a degree of performance and reliability never before attained in microwave equipment!

New in design, the CLR-7 retains all the superior features of the CLR-6: occupies minimum space . . . employs reliable long-life tubes . . . provides highest power output. Then note these additional features of the CLR-7: fewer tubes, lower power consumption, a new and positive frequency control system and complete compatibility with existing wire line and two-way radio facilities *and with any type multiplex equipment!*

Get complete data on this newest microwave equipment . . . let PHILCO help you in the planning of your system. PHILCO maintains a staff of microwave specialists who are experienced system and field engineers. Call a PHILCO representative, or write PHILCO, Dept. EW today.

Note these PHILCO features:

- *Dependable, high quality performance over single or multiple hops*
- *Available in Common Carrier, Industrial and Government bands*
- *Factory-tested and field-tested circuits*
- *Lower operating costs*
- *Designed for frequency-division or time-division multiplex*
- *Highest effective radiated power*

GOVERNMENT & INDUSTRIAL DIVISION • PHILADELPHIA 44, PA.

In Canada: Philco Corporation of Canada Limited, Don Mills, Ontario

Distribution Trends Are Towards

An excellent contrast in appearance between open line wire at the pole tops and insulated aerial cable supported by a messenger running through the trees. Notice how this neat, compact, aerial package eliminates using crossarms.

A distribution engineer's "nightmare" come true. Here is what happened to weatherproof line wire in a January ice storm in New Jersey. In this storm, self-supporting aerial cables continued to operate safely and dependably even though many poles were broken off

INSULATED AERIAL CABLES

Powering homes, farms, and factories in 1963 will take 182 billion more kilowatt hours than it does today. Air-conditioning and refrigeration will consume an additional 45.4 billion kilowatt hours. That's the way load projections look today. To carry this increase, modernization and expansion of distribution systems is compulsory.

More and more utilities are eliminating festooning weatherproof line wire with messenger-supported, insulated aerial cable. Improved electrical efficiency, less expensive maintenance, less tree trimming, minimum danger to life and property, and better appearance are a few advantages of installing insulated aerial cable.

Your Aerial Cable Trend Should Be Towards *Simplex*

HERE'S WHY...

Simplex-ANHYDREX insulated and neoprene-jacketed aerial cables have been used for many years for both power and communication service where maximum service life expectancy is of prime importance. They are simple in construction and easy to install.

When cables up to and including 2,000 volts are Anhydrex-insulated, they have low power factor, low dielectric constant, high dielectric strength, low water absorption, adequate physical properties, and excellent mechanical and electrical stability in water.

For cable operating over 2,000 volts, Anhydrex insulation has lifelong ozone, heat and moisture-resisting properties. It is this combination of desirable properties that makes ANHYDREX XX Insulated Cables so outstanding for high voltage service.

Simplex Aerial Cables have a tough neoprene jacket that withstands abrasion from swaying tree limbs and chafing against poles. It effectively protects against fungus, heat, sunlight, chemicals, corrosion, and weathering. Simplex specially-compounded neoprene provides a light-weight jacket that is ideal for aerial service.

Simplex Aerial Cables are designed to fit service requirements as stipulated by utility distribution engineers. They may be made for the three general methods of support, namely, messenger and ring, self-supporting, and spinner.

For further information about Simplex Aerial Cables and how they may be constructed to suit your needs, write to the address below for Catalog No. 1006.

Simplex INSULATED AERIAL CABLES

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

New Chevrolet Trucks

deliver more power, more ruggedness, for less money!

Making sure the truck you buy has plenty of power and chassis ruggedness is good business in any man's book. Getting the money-saving extra power and ruggedness of Chevrolet trucks is *better* business in any man's book*keeping*.

EXTRA POWER MEANS BIGGER SAVINGS

No doubt about it, the extra power you get from new high-compression Chevrolet truck engines means you're going to pay out less for gasoline. Over a year, that adds up to a sizeable savings. Increased power brings time-saving benefits, too—greater acceleration and hill-climbing ability . . . you haul faster, get the job done quicker!

GREATER RUGGEDNESS CUTS OPERATING COSTS

Heavier axle shafts and wheel hubs on two-ton models; bigger, more durable clutches on light- and heavy-duty models; stronger, more rigid frames on all models. These features pay off in extra-low upkeep costs . . . extra miles of dependable truck life.

But these *while-you-drive* savings aren't all, by a long shot. You even save *when you buy*. For Chevrolet is America's lowest-priced line of trucks. Stop by your Chevrolet dealer's soon to see the "savingest" trucks on the road. He'll show you models ideally suited to your job, with facts to prove you'll get more for your money. Chevrolet Division of General Motors, Detroit 2, Mich.

CHEVROLET

MOST TRUSTWORTHY TRUCKS ON ANY JOB!

CHEVROLET ADVANCE-DESIGN TRUCK FEATURES

THREE GREAT ENGINES—The new "Jobmaster 261" engine* for extra heavy hauling. The "Thriftmaster 235" or "Loadmaster 235" for light-, medium- and heavy-duty hauling. **NEW TRUCK HYDRA-MATIC TRANSMISSION***—offered on ½-, ¾- and 1-ton models. Heavy-Duty **SYNCHRO-MESH TRANSMISSION**—for fast, smooth shifting. **DIAPHRAGM SPRING CLUTCH**—improved action engagement. **HYPOID REAR AXLE**—for longer life on all models. **TORQUE-ACTION BRAKES**—on all wheels on light- and medium-duty models. **TWIN-ACTION REAR WHEEL BRAKES**—on heavy-duty models. **DUAL-SHOE PARKING BRAKE**—greater holding ability on heavy-duty models. **NEW RIDE CONTROL SEAT***—eliminates backrubbing. **NEW, LARGER UNIT-DESIGNED PICKUP AND PLATFORM STAKE BODIES**—give increased load space. **COMFORTMASTER CAB**—offers greater comfort, convenience and safety. **PANORAMIC WINDSHIELD**—for increased driver vision. **WIDE-BASE WHEELS**—for increased tire mileage. **BALL-GEAR STEERING**—easier, safer handling. **ADVANCE-DESIGN STYLING**—rugged, handsome appearance.

**Optional at extra cost. Ride Control Seat is available on all cabs of 1½- and 2-ton models, standard cabs only in other models. "Jobmaster 261" engine available on 2-ton models, truck Hydra-Matic transmission on ½-, ¾- and 1-ton models.*

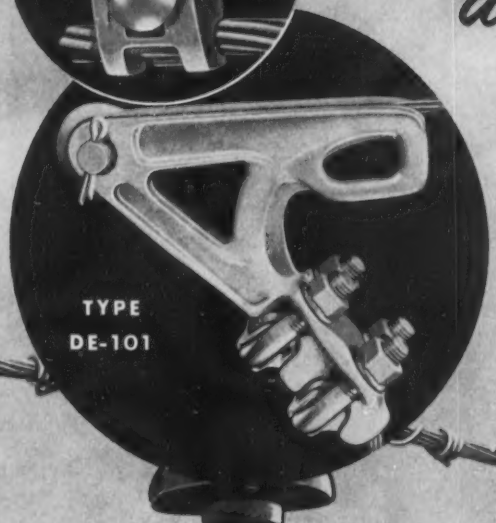
TOP OF THE LINE

DEPENDABLE, LIGHTWEIGHT, LIFETIME

ANDERSON

Aluminum CONNECTORS

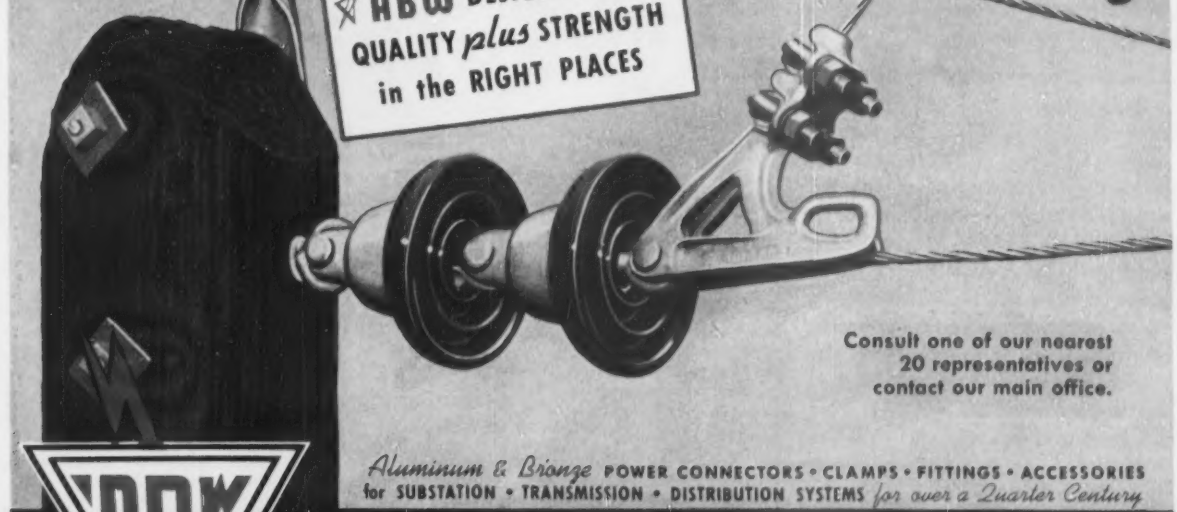
A TROUBLE-FREE COMBINATION . . LC-81A AND DE-101 . . . WITH ALL THE "BUGS" ENGINEERED OUT! DESIGNED FOR EASY HANDLING AND QUICK, POSITIVE INSTALLATION!



ANDERSON connectors, clamps, fittings and accessories are designed and engineered for strength, durability and high efficiency. ABW products are recognized standards in the industry.

ANDERSON makes "top of the line" handling of power connectors, clamps, fittings and accessories *fumble-proof*, too! Usually, just one wrench is the only tool a lineman will need.

☆ **ABW DESIGN MEANS QUALITY *plus* STRENGTH in the RIGHT PLACES**



Consult one of our nearest 20 representatives or contact our main office.

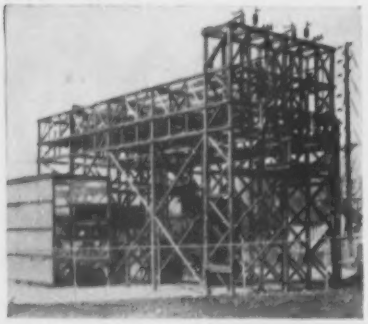
Aluminum & Bronze POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES for SUBSTATION • TRANSMISSION • DISTRIBUTION SYSTEMS *for over a Quarter Century*

ABW

ANDERSON BRASS WORKS, INC.

P. O. DRAWER 2151 • BIRMINGHAM 1, ALABAMA

FIELD PERFORMANCE RECORDS



ENGINEERING NOTES...

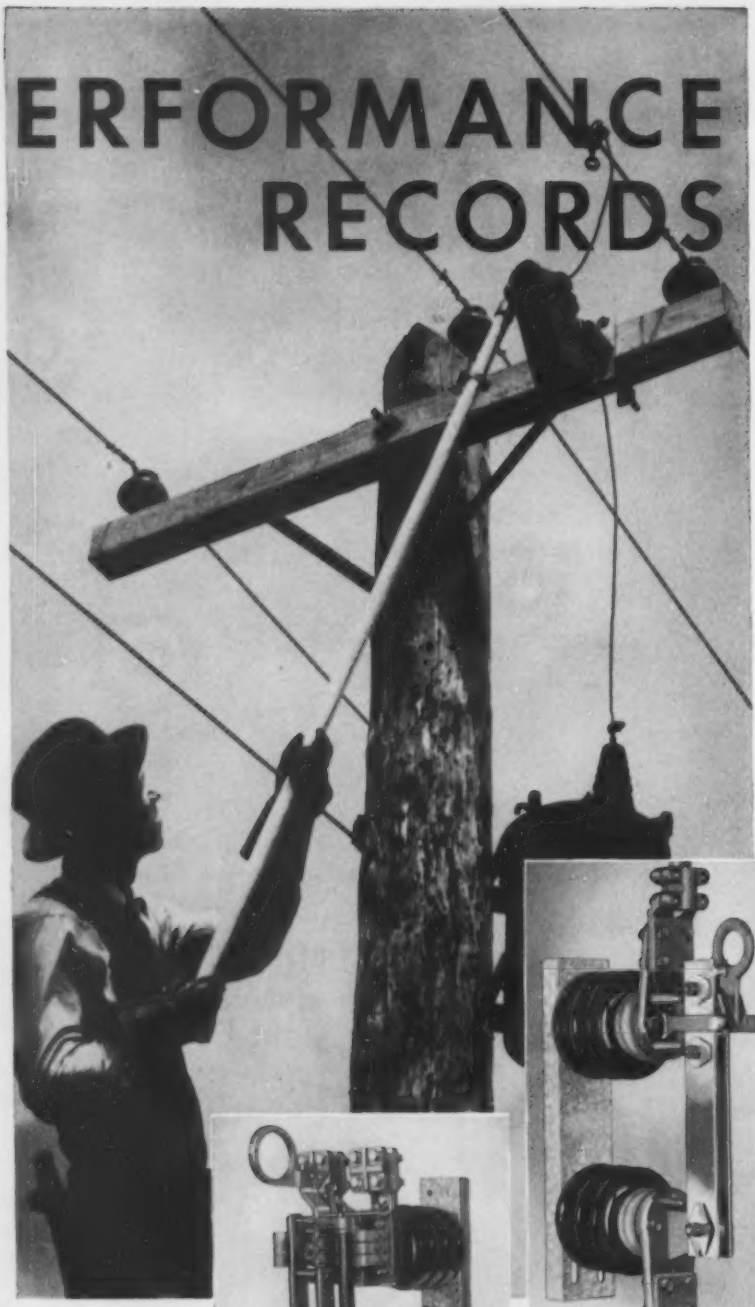
Electronic Switch Triggers Tests At Kearney Substation Laboratory

POWER follow current is initiated in lightning arresters and fuse cutouts by an electronic circuit at our test substation. Designed and built by Kearney engineers this switch enables them to start follow current at any desired point on the line voltage wave within the range of 10° to 170° positive or negative. Repeated shots on specified points of the wave provide exacting tests of equipment operation.

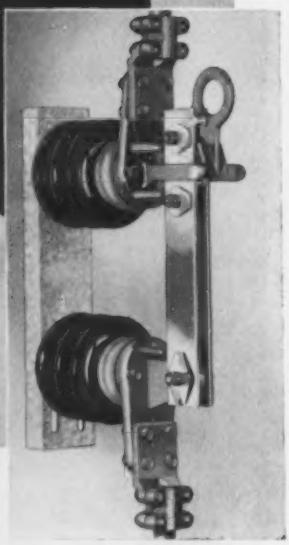
Oversimplified, the circuit consists of a pulse activated Thyratron which fires a surge generator automatically. An R-C circuit selects the proper phase relationship with the substation supply voltage and feeds a limiter stage. The square wave output of this amplifier is then differentiated into pips. These steep pulses are impressed on the normally negative grid of the Thyratron. A manually operated relay removes the negative cut-off voltage from the grid and the tube fires on the first positive pulse occurring thereafter, triggering the surge generator and starting the follow current.

When you specify Kearney Products you are getting the best equipment that exhaustive research, design study and test can produce for the power field.

-208



By pass voltage regulators safely and economically with this Kearney Regulator By-Pass Switch. Replaces three single pole hook operated switches formerly required for the job.



High conductivity current paths, standard on all Kearney Disconnect Switches, reduce operating temperature, cut replacement costs.

KEARNEY

Prove the Value of KEARNEY PRODUCTS

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. GUELPH, ONT.

"The Mark of Quality Products"

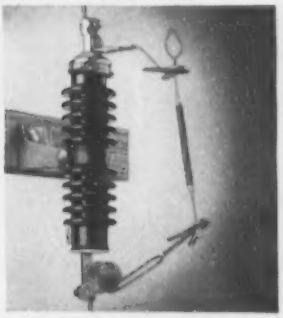
POSITIVE PERFORMANCE, sturdy construction, designed and built for modern distribution service, these are the reasons why operating men prefer Kearney Equipment.

When loads multiply, as they are doing right now, distribution apparatus especially, demands positive performance. The equipment shown on these pages has been engineered and field-tested for trouble-free service under today's . . . not yesterday's . . . load. That's why they are standard with most of America's forward looking power companies.

Sturdy, heavied-up construction of Kearney Products saves maintenance trips, increases profits everywhere they're used. You can count on long, hard service in all types of climates; in all types of atmospheres.

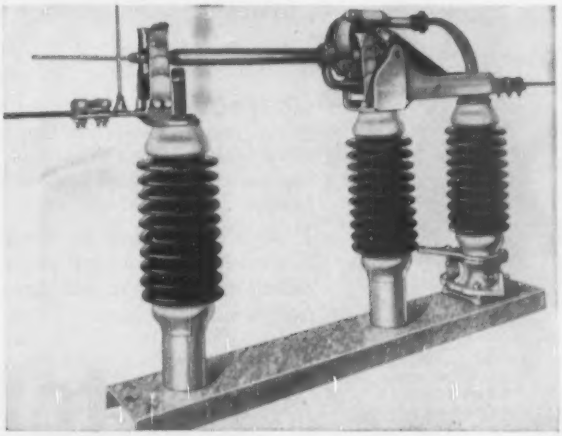
Write for complete technical information on these products. Compare feature for feature, value for value. See for yourself why more and more men in the field are specifying "All Kearney" on their orders.

JAMES R. KEARNEY CORPORATION
4224-42 CLAYTON AVE. • ST. LOUIS 10, MO.
Canadian Plant, Guelph, Ontario

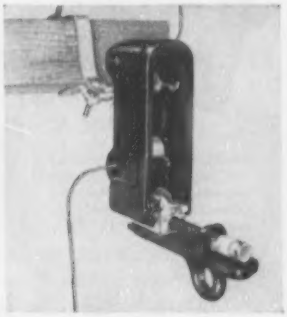


The Trip-O-Link, a Kearney invention has given 100% full load protection to rural lines for over 15 years.

Trip Outs provide reliable heavy-duty protection at sustained maximum load ratings without damage to cutout.



Kearney Group Operated Switches are made fully adjustable to compensate for shifts in mounting structure or play in interphase rod travel. Fully adjustable design adds years to normal switch life; cuts replacement cost. Beryllium copper spring contacts provide high pressure current transfer at both ends of blade for cooler operation. Oilite bearings align blades with contacts and allow full wiping action. Dependable, all-weather operating mechanism works smoothly whenever routine or trouble requires quick action.



The Trip-O-Matic guards expensive distribution equipment; provides full protection for systems subject to widely varying city fault conditions.

PRODUCTS *for Better Construction Safer Maintenance*

Motorola 2-way Radio ... the profit tool that keeps pace with the expanding Power Utility Industry

Continuity of Service is being maintained today with a higher guarantee and at lower cost by hundreds of electric power companies. Alert dispatching via Motorola 2-way radio has accounted for great gains in the overall efficiency of these service organizations.

And as capacity is doubling every ten years — so is the use of Motorola radio communication systems . . . and no wonder . . . these highly reliable and flexible tools have multiple applications with gains on the books for every department that uses them.

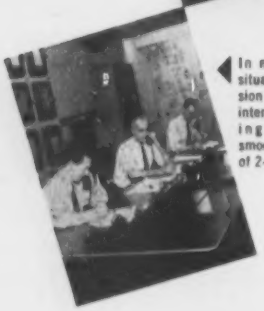
Easily integrated into your existing operation for improvements in customer relations, maintenance schedules, employee relations, cost control, and a multitude of minor problem areas.

The radio controlled operation is the more-profit operation

Orders quickly dispatched to line service and repair trucks eliminates much dead mileage and minimizes waiting and overtime.

Night emergency calls in bad weather are handled in 1-2-3 order enabling home service units to keep on schedule when demands get heavy

Powerline construction and repair work is expedited by constantly available, mobile communication between distant line crews, parts and supply departments.



In many emergency situations the supervision and expediting of interstation load switching is "rescued" smoothly with the aid of 2-way radio.

MOST POWER utilities insist on Motorola for their radio communications equipment because they have learned from first-hand experience to expect top performance and utmost reliability. They have found—

It pays to own and operate your own 2-way radio communications, the tool pioneered to practical success by the world's largest exclusively radio and electronics manufacturers.

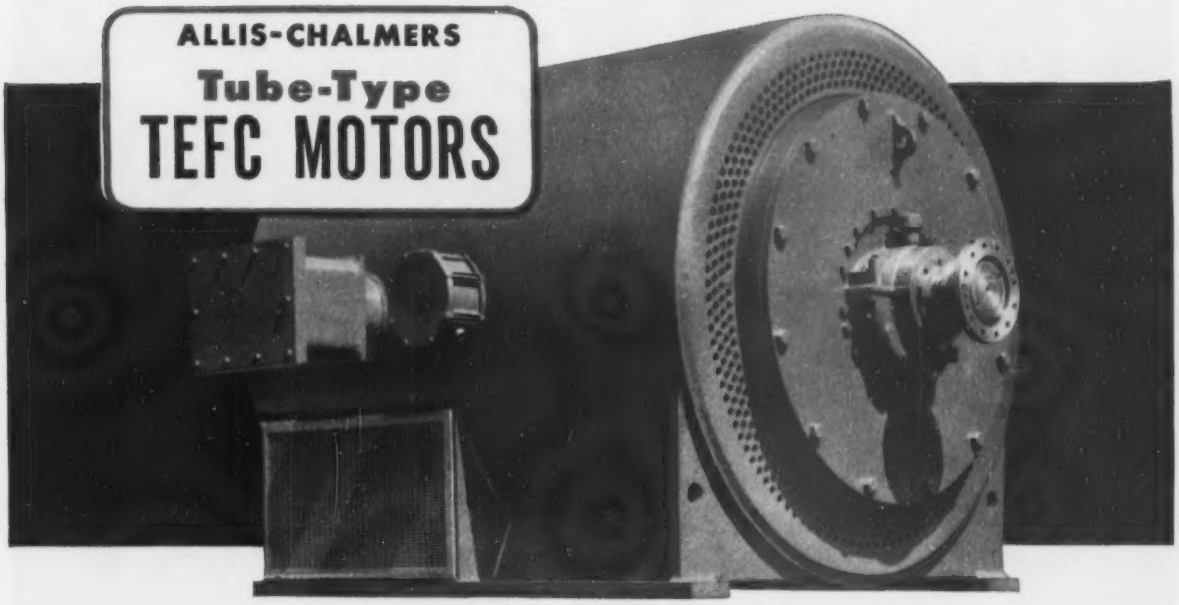
Motorola®

The complete supplier of radio communications and industrial control, microwave relay, power line carrier, supervisory control and frequency shift V. F. carrier, mobile communication, telemetering, automatic load control, teleprinting, and protective relaying.

Motorola Communications & Electronics, Inc., 4501 W. Augusta, Chicago 51, Ill.

NOW 1250 Hp – 1780 Rpm Underwriters' Approved

for Class I, Group D Service



Allis-Chalmers explosion-proof motors as large as 1250 hp, 2300 volts, 1780 rpm are now available with Underwriters' Laboratories, Inc. labels for operation in Class I, Group D hazardous locations.

Ratings up to 800 hp, 3600 rpm.

Construction used for larger ratings.

Previous to recent tests, the Allis-Chalmers Underwriter-approved motor line included ratings up to 800 hp, 3600 rpm for operation in Class I, Group D and Class II, Group F and G locations. Now, with the design used for larger ratings also Underwriters' test-proved, Allis-Chalmers can supply explosion-proof motors in other ratings required by industry.

Explosion-Proof Plus

Operation-proved by TEFC motors totaling over a quarter million horsepower, the A-C tube-type air-to-air heat exchanger design combines safety and maximum operating economy. Self-cleaning action cuts maintenance. Full internal air circulation lengthens insulation life. Complete enclosure protects stator core and other electrical parts from dirt and corrosion.

For approved motors for hazardous dust and gas locations, contact your A-C representative, or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

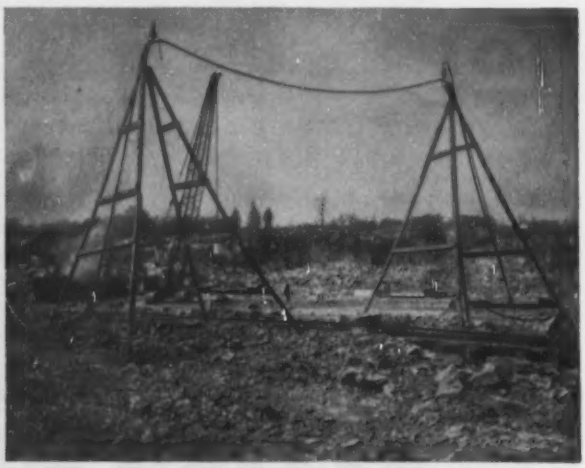
A-4436

ALLIS-CHALMERS

"Our *Tiger Brand*

NOTICE THE CABLE TRAY fastened to the shovel. This was developed by Universal Atlas for easier cable handling.

TWO WORKMAN WATCH from blast shelter as charge is set off in distance. Low horses cushion cable from shock of falling rock.



HERE A CABLE is raised on horses to clear the railroad track. It feeds the shovel visible in background.

Amerclad lasted 12 years"

Says Chief Electrician, Hudson Plant
Universal Atlas Cement Company

Year after year, at this quarry, the Amerclad is exposed to knife-sharp fragments of flying rock. During the summer, the rock often gets so hot that you can't even touch it. Other times, the cable lies out in the rain and snow—often at sub-zero temperatures.

At the Hudson, N. Y. quarry of Universal Atlas, Chief Electrician Frank Rodmond said, "This Amerclad runs the constant danger of being hit with flying rock fragments through secondary blasting. Yet the down-time cost of this operation is so high that we just can't stand cables that keep failing. We kept that last batch of Amerclad 12 years before we replaced it, yet it was still serviceable when we switched over to new Amerclad."

If you want service like this, specify Amerclad the next time you need cable that can really take it. Amerclad is available in a great many sizes and constructions, with or without shielding. There is a type to power anything from a river dredge or mine locomotive down to a rough and tumble electric hand drill. *Send the coupon,* and get more information.

AMERICAN STEEL & WIRE DIVISION
UNITED STATES STEEL CORPORATION
GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

THIS IS A TYPICAL DRILL. It uses a 4-conductor No. 8 Amerclad cable.

A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB!

paper & varnished cambric cable
asbestos wire and cable
aerial, underground & submarine cable
shovel & dredge cable
mold cured portable cord
machine tool & building wire
special purpose wire & cable

SEND THE COUPON

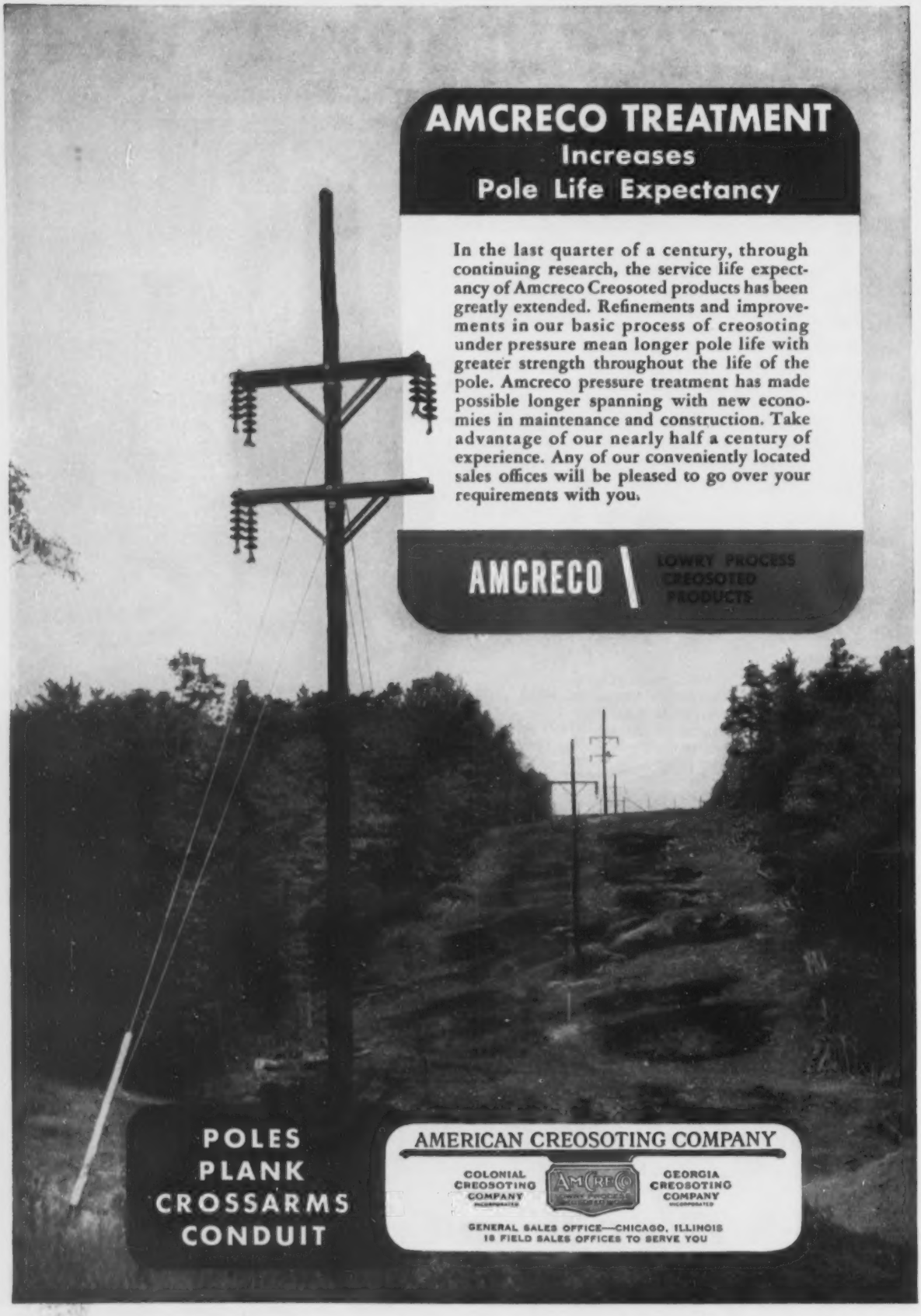
American Steel & Wire Division
Room EE-84, Rockefeller Building
Cleveland 13, Ohio

☐ Please give me more information about Amerclad.
☐ I'd like to talk to your representative.

Name .....
Firm .....
Address .....
City ..... State.....

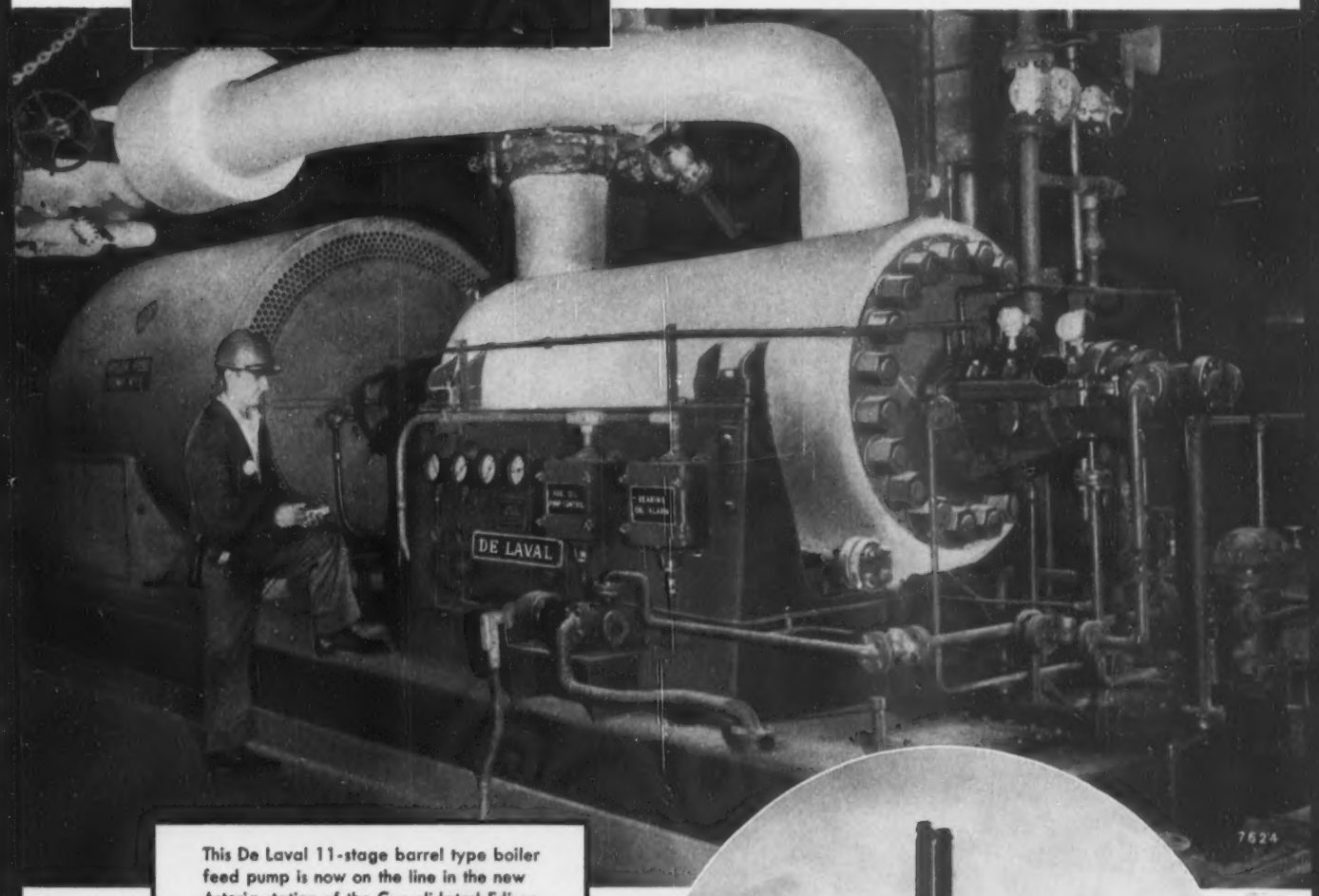
U·S·S. Tiger Brand **ELECTRICAL WIRE & CABLE** USS

UNITED STATES STEEL

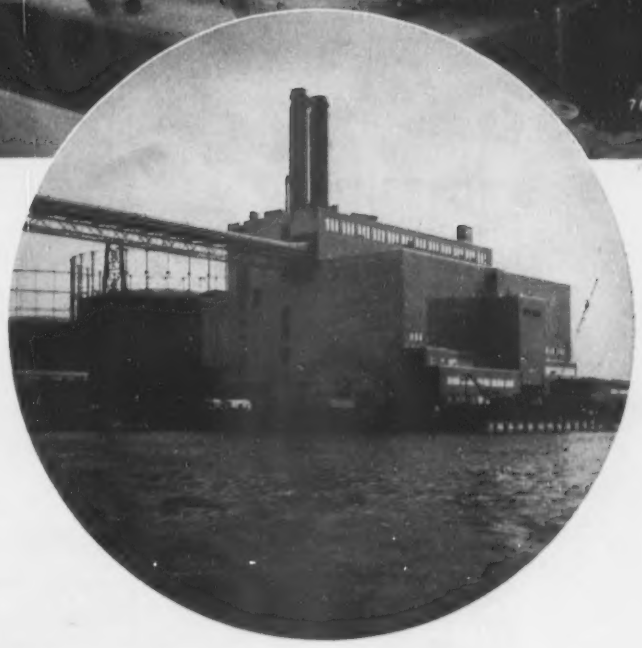

AMCRECO TREATMENT
Increases
Pole Life Expectancy
In the last quarter of a century, through continuing research, the service life expectancy of Amcreco Creosoted products has been greatly extended. Refinements and improvements in our basic process of creosoting under pressure mean longer pole life with greater strength throughout the life of the pole. Amcreco pressure treatment has made possible longer spanning with new economies in maintenance and construction. Take advantage of our nearly half a century of experience. Any of our conveniently located sales offices will be pleased to go over your requirements with you.
AMCRECO
LOWRY PROCESS CREOSOTED PRODUCTS
POLES
PLANK
CROSSARMS
CONDUIT
AMERICAN CREOSOTING COMPANY
COLONIAL CREOSOTING COMPANY
GEORGIA CREOSOTING COMPANY
GENERAL SALES OFFICE—CHICAGO, ILLINOIS
18 FIELD SALES OFFICES TO SERVE YOU

DE LAVAL
BARREL TYPE BOILER FEED PUMP

in new Con Edison *Astoria power station*



This De Laval 11-stage barrel type boiler feed pump is now on the line in the new Astoria station of the Consolidated Edison Co. of New York.



The De Laval 8/6 pump operates at 129 psig suction pressure and delivers 1,570 gpm of 344 F water against 2,229 discharge pressure. Direct-connected at the end of the boiler feed pump shaft is a De Laval IMO pump for lubrication of the main pump and motor bearings. Also furnished is a motor-driven De Laval IMO auxiliary oil pump with pressure controlled switches. De Laval barrel type boiler feed pumps meet all the requirements of high pressure, high temperature boiler feed service. The distinctive De Laval design assures years of reliable operation with minimum maintenance.

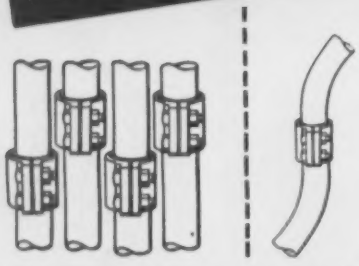
DE LAVAL *Boiler Feed Pumps*

DE LAVAL STEAM TURBINE COMPANY

861 Nottingham Way, Trenton 2, New Jersey

*"TOUGH" conduit coupling jobs

(Type "SP")
Interior thread meshes with conduit threading for rigid, tight-fitting connection.
are easy with O. Z.
split couplings
Bolt heads are held in place by shoulder on coupling, eliminating need for second tool.
One piece malleable iron construction facilitates handling during installation.
To install, simply slip over one conduit end, butt ends of both conduits, slide fitting back into position and tighten nuts.



* **"Tough"**—(Where ordinary couplings can't be installed). Are clearances close—near floor, wall, ceiling or other obstructions? Can conduits be turned due to bends? Is space or accessibility a factor? Just install an O. Z. Type "SP" Split Coupling.

Butt the conduit ends within the O. Z. Split Coupling —tighten two nuts with an ordinary open-end wrench and presto . . . you have a permanent, close-fitting, rigid connection.

Drastically reduced installation costs, plus initial savings of as much as 50% in larger sizes, over similar competitive fittings, are just two of the many reasons why you should specify O. Z. Split Couplings for your difficult conduit coupling jobs.

Call your local O. Z. distributor . . . he is ready to make immediate delivery from stock on sizes from ½" to 5".

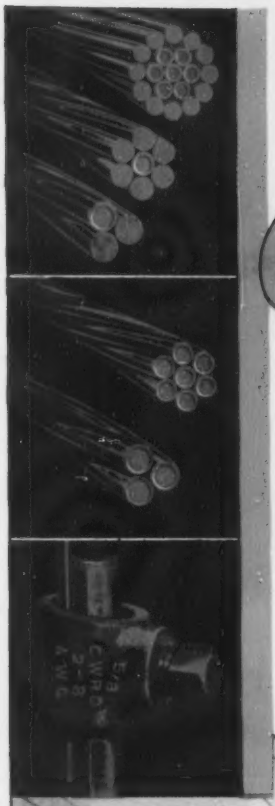
O. Z. ELECTRICAL MANUFACTURING CO., INC.

262 BOND ST. • BROOKLYN 17, N.Y.

CAST IRON BOXES • SOLDERLESS CONNECTORS
CABLE TERMINATORS • GROUNDING DEVICES
POWER CONNECTORS • CONDUIT FITTINGS

CUT OVERHEAD EXPENSE ON YOUR OVERHEAD LINES WITH Copperweld

TRADE MARK



POWER CONDUCTORS

SHIELD WIRES

GUY AND MESSENGER STRAND

GROUND RODS AND CLAMPS

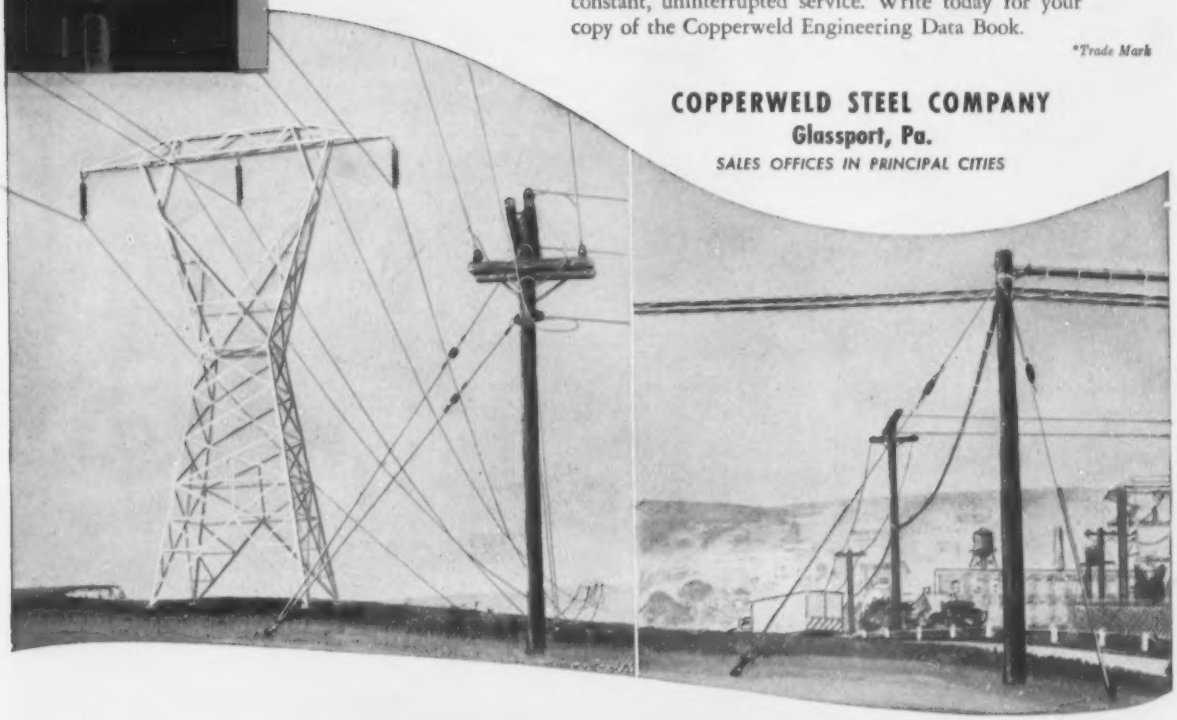
For over 38 years Copperweld* Products have provided dependable service to the Electrical Industry. Their trouble-free performance has been proved by time. Their lowest annual cost is a matter of record.

When you build with Copperweld Products, you get the long life and conductance of copper inseparably molten-welded to a core of high strength steel. And because Copperweld can't rust, this original high strength is retained for the life of the installation. This means your overhead lines will have the stamina to stand up under all types of operating conditions.

Profit by the experience of many of the world's leading power companies, railroads, and communication systems. Specify Copperweld Conductors, Shield Wires, Strand and Ground Rods for your overhead lines. There is no better way to keep the power load up, keep overhead down and be assured of constant, uninterrupted service. Write today for your copy of the Copperweld Engineering Data Book.

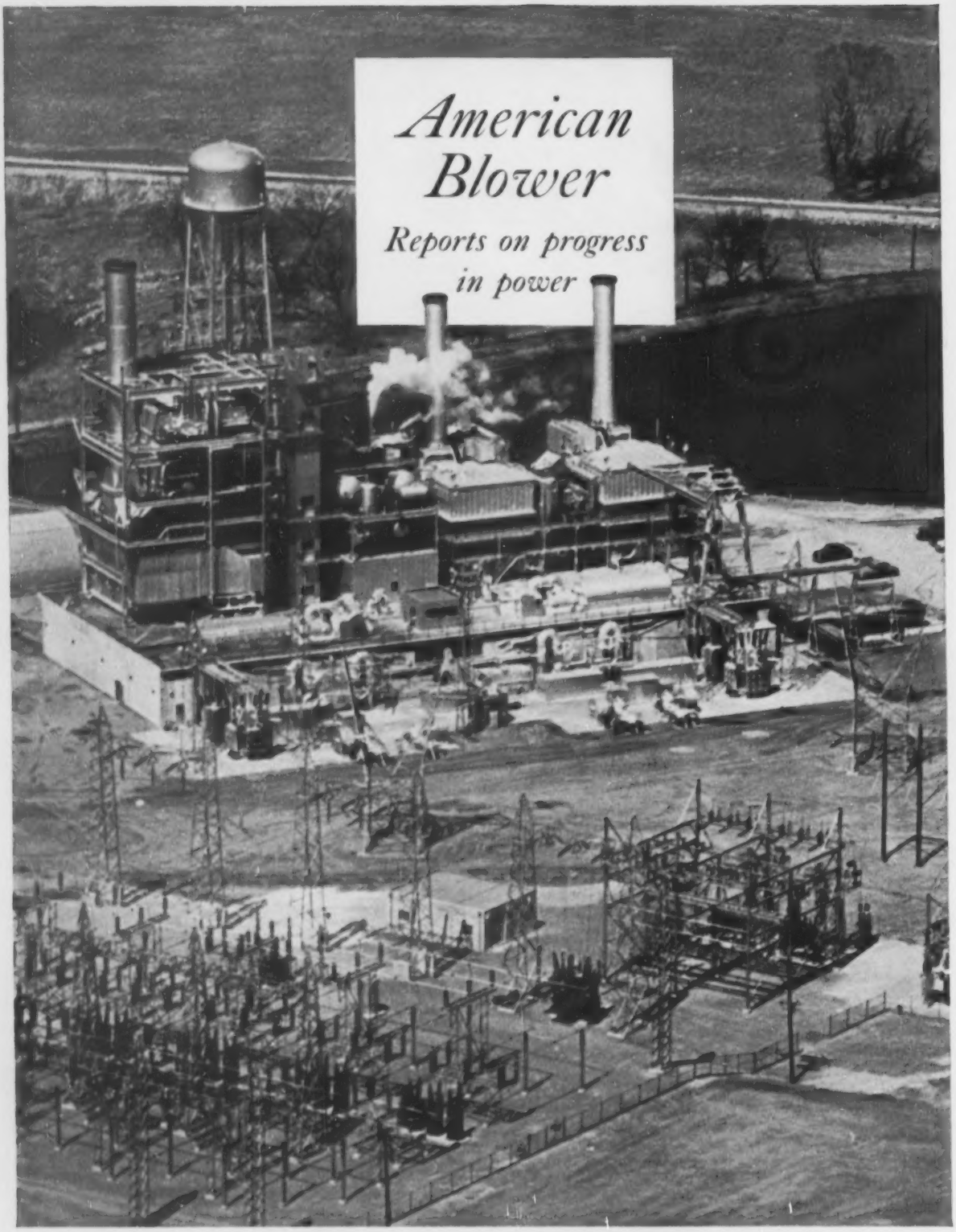
*Trade Mark

COPPERWELD STEEL COMPANY
Glassport, Pa.
SALES OFFICES IN PRINCIPAL CITIES



Copperweld TRADE MARK **PRODUCTS**

Cost Less BECAUSE THEY *Last Longer*



Pictured above is the new Southwestern Station of the Public Service Company of Oklahoma, located on the Washita River, 27 miles west of Chickasha, in the heart of southwestern Oklahoma. This new station assures an abundant supply of dependable electric service for homes, farms, offices and factories.

Serving home and industry: **AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS &**

New power for Western Oklahoma

American Blower helps the Public Service Company of Oklahoma expand to meet increasing electrical needs

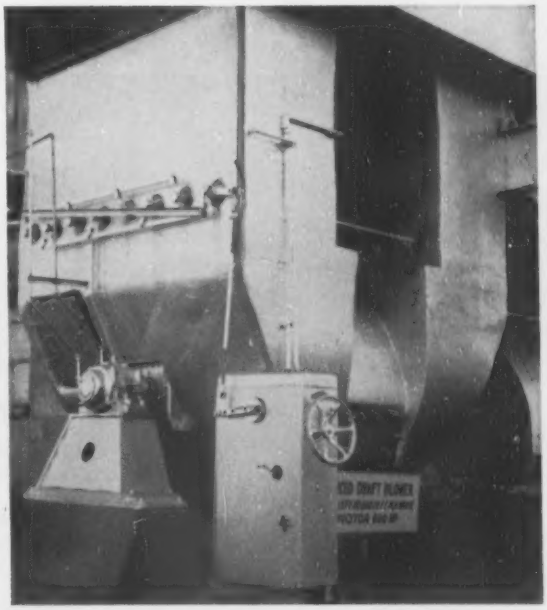
When present expansion plans are complete, the Public Service Company of Oklahoma will have spent $40 to $45 million on three new steam generating units, the second of which went "on the line" March 1954. When completed, the three new units will develop a total of 362,000 H.P., enough to make the Southwestern Station one of the largest steam electric generating plants between the Rocky Mountains and the Mississippi River.

This large investment brings more abundant, low-cost electricity – and a new vitality! – to thousands of homes, farms and factories. Naturally, Public Service Company of Oklahoma, a progressive, investor-owned utility, spends wisely.

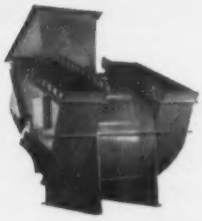
Careful search found an ideal location; careful selection assured the finest, most efficient, most economical equipment . . . including American Blower Forced Draft Fans.

It is significant that Public Service Company of Oklahoma chose American Blower Equipment. Like so many other leading power companies, who use American Blower Mechanical Draft Fans, Heavy-duty Steam Coils, Fly Ash Precipitators and Gyrol Fluid Drives for boiler feed pump and fan control, the Public Service Company of Oklahoma knows it can depend on American Blower equipment.

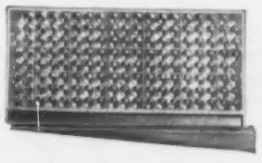
If you plan to modernize or expand your facilities, contact your nearest American Blower Branch Office, or write us direct.



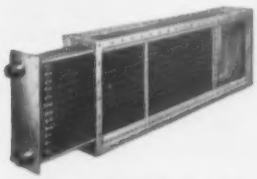
Outdoor installation of American Blower Forced Draft Fan. It is well protected against hail, dust, sand and snow. American Blower Engineers, with their wide experience, can help with your power problems. Give them a call.



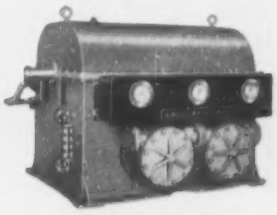
Mechanical Draft Fans for induced and forced draft



Collectors and precipitators for dust and fly ash control



Heavy-duty steam coils for high pressure duty



Gyrol Fluid Drives for boiler feed pump and fan control

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN • CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

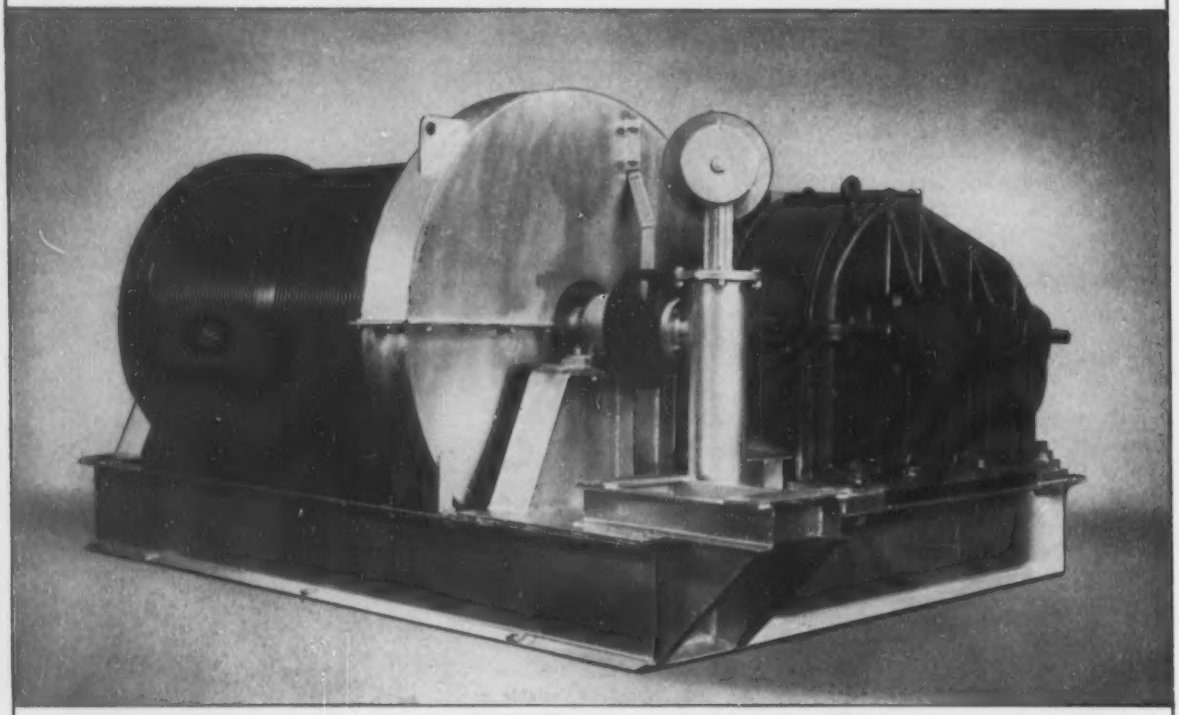
AMERICAN BLOWER

WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

INTAKE GATE HOIST

built by **PACECO**

"TAILORS OF STEEL"®



Southern California Edison Company, Big Creek, California

Built to handle the 8′ x 17′8″ intake wheel gates at entrance to penstock, hoists lift at 2.75′ per min. Hoists are arranged for hand or gasoline motor emergency operation. Control is by means of push buttons mounted on the hoist unit. All parts are of welded steel construction mounted on a rigid welded steel frame.

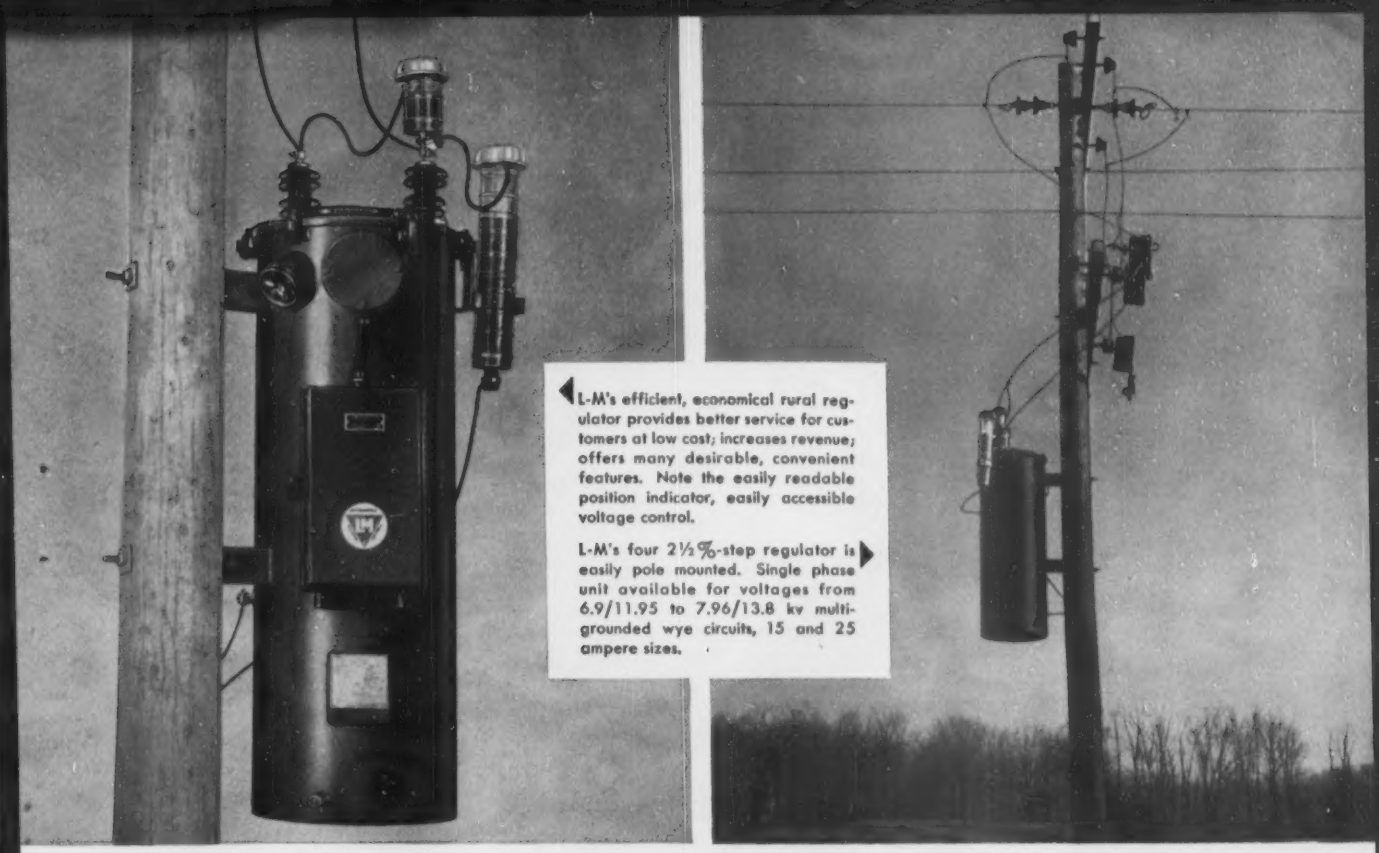
Pacific Coast Engineering Company invites your inquiries when your needs fall within our scope of service, including cranes, gates, hoists, penstocks, pipe, valves and other units requiring skilled fabrication of metal plate and precision machine work.

One job . . . one responsibility.

PACIFIC COAST ENGINEERING COMPANY

Alameda, California

ENGINEERS • MACHINISTS • FABRICATORS



L-M's efficient, economical rural regulator provides better service for customers at low cost; increases revenue; offers many desirable, convenient features. Note the easily readable position indicator, easily accessible voltage control.

L-M's four 2½%-step regulator is easily pole mounted. Single phase unit available for voltages from 6.9/11.95 to 7.96/13.8 kv multi-grounded wye circuits, 15 and 25 ampere sizes.

L-M Offers New, Simple Regulator For Rural Service at Only $786!

You don't have to spend a lot of money for adequate regulation on rural lines. L-M has developed a new rural regulator, with four 2½% steps, that will give adequate, dependable operation where conditions do not require critically fine regulation.

The use of this regulator increases revenue—probably enough to pay for the regulator in the first year, in many cases. It provides the customer with better performance of appliances, lights and other electrical equipment—and it costs only $786 in the 15 ampere size, $951 in the 25 ampere size.

The L-M regulator is available in 7620 volt rating, 15 and 25 ampere sizes, 60 cycle, single phase. Four 2½% steps provide 10% boost; 7½% boost and 2½% buck; 5% boost and 5% buck; 2½% boost and 7½% buck; or 10% buck. For use on 7.62/13.2, 7.2/12.47, 7.96/13.8, and 6.9/11.95 kv multi-grounded wye circuits (common terminal grounded to tank). Control winding is tapped so control voltage can be 120 volts for either 7620 or 7200 volt primary operation. Contact-making voltmeter can be adjusted to maintain any voltage level between 110 and 130 at recommended band width of ± 2 volts.

Principal Features of L-M's New Regulator

Rugged long-life tap-changing mechanism.

Low contact maintenance.

Detachable, easily adjustable control—with L-M's accurate, contact-making voltmeter. Control can be installed at the base of the pole.

Electrically operated counter on the control, where it is easily accessible for record-keeping.

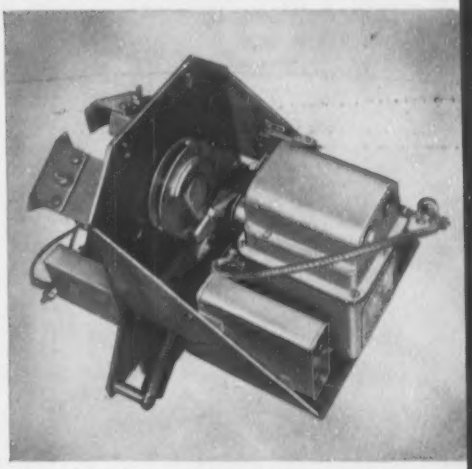
Scientifically designed speed control in tap changer prolongs contact life.

Large tap position indicator easily read from the ground.

Geneva gear drive provides positive contact positioning.

Mechanical stops in addition to limit switches.

Core-coil assembly is L-M's exclusive Round-Wound (TM) design. Tank is filled with ORTO®, L-M's inhibited oxidation-resistant transformer oil.



View of tap changer mechanism showing simplified design and construction.

Get Complete Information

Ask the L-M Field Engineer for details and Bulletin RV1 on the L-M Regulator. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

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LINE MATERIAL *Regulators*

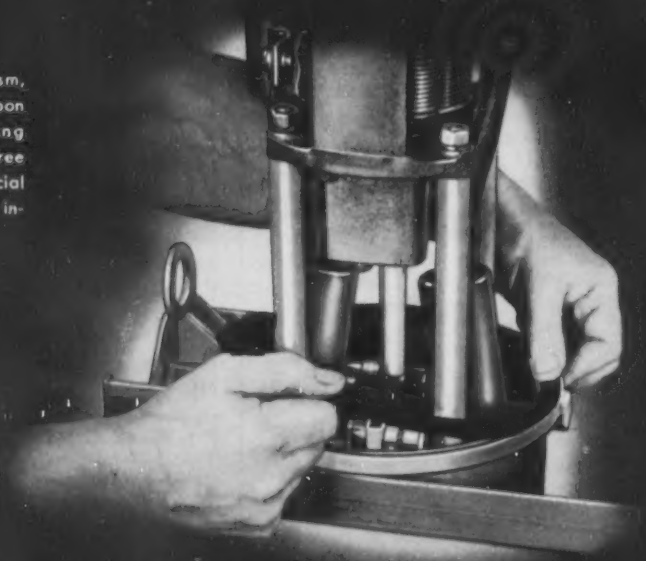
Typical Procedures for Kyle Recloser Maintenance

Check mechanism to see if contacts close freely, are smooth and free from carbon. L-M offers a complete contact assembly which is pre-adjusted at the factory and very easy to install.

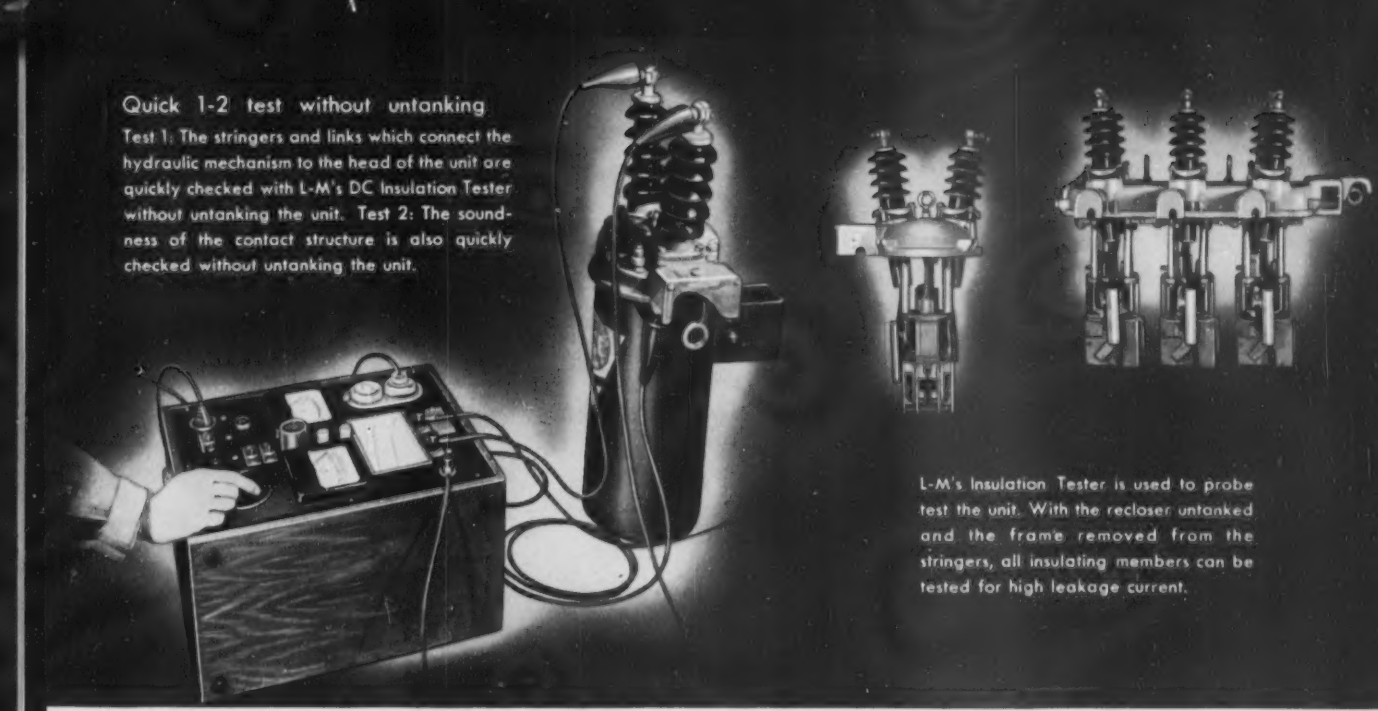
If liner shows signs of moisture such as blisters, or softness at bottom, it is an indication that the recloser may need drying out. The liner should be replaced or dried out when there are signs of moisture.

Clean tank with new oil and thoroughly wipe out carbon deposit. Refill with oil that has been hi-pot tested, whether new or reclaimed. (New oil may have absorbed moisture if the drum was left open for any length of time.)

Clean mechanism, removing all carbon traces by wiping with clean, lint-free cloth, paying special attention to all insulating parts.



Before mechanism is replaced in tank, check and install a new head gasket, if necessary, to insure a good seal against moisture.



Quick 1-2 test without untanking

Test 1: The stringers and links which connect the hydraulic mechanism to the head of the unit are quickly checked with L-M's DC Insulation Tester without untanking the unit. Test 2: The soundness of the contact structure is also quickly checked without untanking the unit.

L-M's Insulation Tester is used to probe test the unit. With the recloser untanked and the frame removed from the stringers, all insulating members can be tested for high leakage current.

Take Advantage of Longest Practical Maintenance Cycle in Kyle® Reclosers

The maintenance cycle may be one, three, or more years, depending on climatic conditions and the duty imposed on the recloser. A method is given for determining frequency and simplifying maintenance.

by **R. C. KIRK**
Manager
Kyle Products Sales
Line Material Company

Many Kyle reclosers are still in operation after three, four, or more years without any maintenance. To assure dependable and continued operation, such reclosers should be checked. Kyle engineers recommend a program of spot checking reclosers, to determine the longest safe maintenance cycle for your operating conditions.

The length of time a recloser can be operated without maintenance depends on several factors. Collection of moisture, for example, is a result of time, loads, and climatic conditions. The collection of carbon is, of course, a result of the operating duty, i.e., the number of arc interruptions, magnitude of the current, voltage, and power factor of the fault current. These factors, involved in determining the recloser maintenance cycle, vary with each section of the country and with the operating duty imposed on the recloser. To obtain the longest practical maintenance cycle you should organize a program that meets your individual requirements.

One means of making a quick insulation check, without disassembling the recloser, is with L-M's new DC Insulation Tester. This is a highly efficient, low-priced portable unit that accurately determines the condition of insulation in reclosers and other apparatus.

If you find it necessary to replace the contacts on the recloser, it is advisable to replace the complete contact assembly, because this insures obtaining the proper setting of the contacts without calibration equipment. L-M makes available a complete contact assembly which is pre-adjusted at the factory and very easy to install. All the insulation parts as well as the contact assembly are shipped in a sealed plastic bag so that they will be protected from moisture in handling and storage.

Get The Facts On Maintenance

The L-M Field Engineer can help you with your maintenance problems. Discuss them with him—you'll find his advice helpful. Detailed maintenance instruction bulletins are available for Kyle reclosers, switches and sectionalizers. A bulletin that discusses factors determining the frequency of maintenance periods and how maintenance should be done is also available. Ask your L-M Field Engineer for these bulletins or write Kyle Products Division, Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Coils are vacuum-impregnated and shipped in oil-filled, sealed cans. L-M reclosers are so constructed that coils of different ampere ratings are interchangeable.

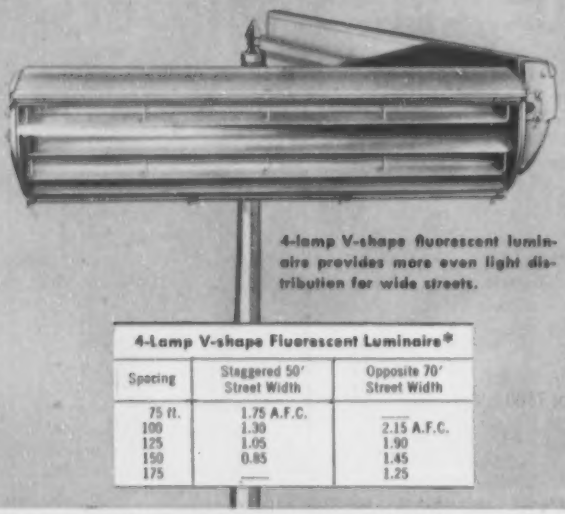
Other insulation parts as well as the contact assembly are shipped in sealed plastic bags to protect against moisture and dirt.

LINE MATERIAL Kyle® Reclosers

Wide asymmetric distribution now available with fluorescent lighting for business districts, highways, and parking areas. Chart: Light distribution pattern for 4-lamp V-shape L-M fluorescent luminaire.

L-M Fluorescent Luminaire Installation Data

Average foot candles at 50° F. temp. in still air—25' mounting height. Illustrations below show L-M's various types of units and mountings, together with the average foot candles on the street with various spacings.



4-lamp V-shape fluorescent luminaire provides more even light distribution for wide streets.

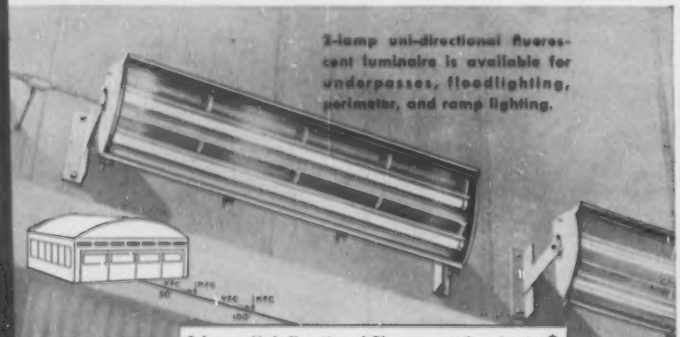
4-Lamp V-shape Fluorescent Luminaire*

Spacing	Staggered 50' Street Width	Opposite 70' Street Width
75 ft.	1.75 A.F.C.	—
100	1.30	2.15 A.F.C.
125	1.05	1.90
150	0.85	1.45
175	—	1.25

4-lamp bi-directional fluorescent luminaire provides a broader light pattern for center parkway and area lighting.

4-Lamp Horizontal-mounted Fluorescent Luminaire*

Spacing	Center-Mounted Twin Arm 40' Road Twin Roadways	Staggered 50' Street Width	Opposite 70' Street Width
75 ft.	2.85 A.F.C.	1.35 A.F.C.	—
100	2.15	1.00	1.55 A.F.C.
125	1.70	0.80	1.26
150	1.40	0.65	1.05
175	1.20	—	0.90

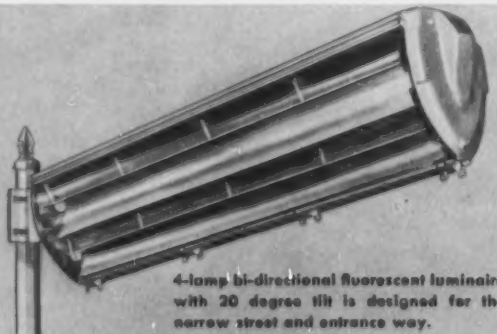


2-lamp uni-directional fluorescent luminaire is available for underpasses, floodlighting, perimeter, and ramp lighting.

2-Lamp Uni-directional Fluorescent Luminaire*

Readings were made of ramp installation consisting of ten 2-lamp uni-directional fluorescent luminaires. 22' mounting height—spaced 8' on center.

Dist. From Source	Vertical F.C.	Horizontal F.C.
50 ft.	9.70	6.50
100	2.40	1.20
150	1.10	0.35
200	0.65	0.05
250	0.40	—
300	0.25	—
350	0.20	—

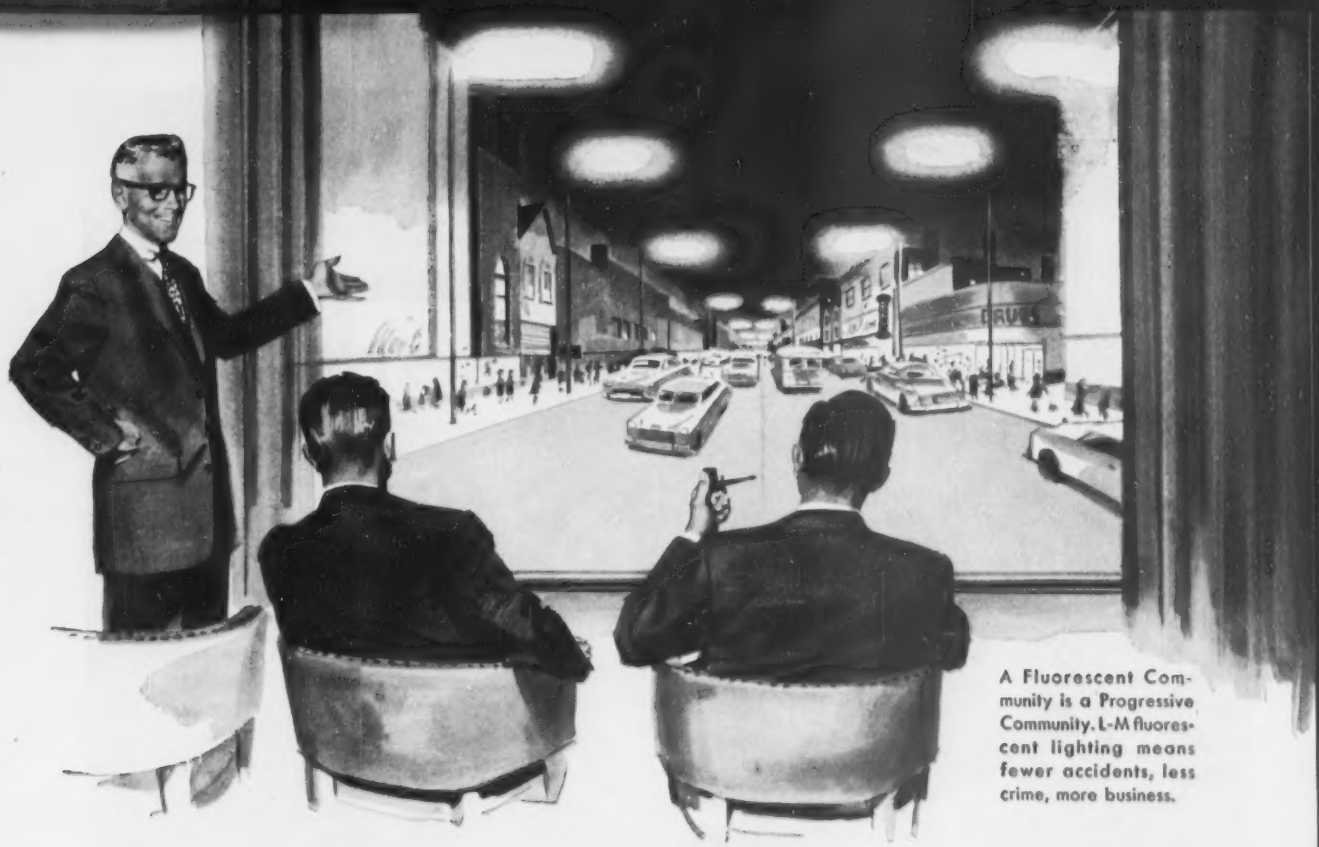


4-lamp bi-directional fluorescent luminaire with 20 degree tilt is designed for the narrow street and entrance way.

4-Lamp Tilted Fluorescent Luminaire (20° Tilt)*

Spacing	Staggered 40' Street Width	Staggered 50' Street Width	Opposite 70' Street Width
75 ft.	1.50 A.F.C.	1.35 A.F.C.	—
100	1.15	1.05	1.60 A.F.C.
125	0.90	0.80	1.30
150	0.75	0.65	1.10
175	—	—	0.90

*From test reports E353-83, E353-817, E353-810, E353-88.



A Fluorescent Community is a Progressive Community. L-M fluorescent lighting means fewer accidents, less crime, more business.

L-M's New Fluorescent Street Lighting Luminaire
Large Light Source, Minimum Glare

By **STACY STANDLEY**
Manager
Lighting Sales
Line Material Company

L-M's New Fluorescent Luminaire is a revolutionary improvement in street lighting. With its large light source the fluorescent luminaire produces an even, cool white color over a large area. Because of its large light source, it provides virtually glareless illumination.

Fluorescent luminaires provide a light that is particularly advantageous in business and shopping sections. The surrounding sidewalk area adjacent to the curb is illuminated and gradually fades out to make the background contrast as gradual as possible. This provides a wider scope of vision for both the motorist and the pedestrian, in addition to creating a cheerful and active atmosphere in the shopping area.

L-M's New Fluorescent Luminaires are available in these styles:

1 4-lamp V-shape for use on wide streets

2 4-lamp bi-directional tilted 20° toward the street for narrower streets and entrance ways

3 4-lamp bi-directional with level horizontal mounting for center parkway and area lighting

4 2-lamp uni-directional for underpass, flood lighting, perimeter and ramp lighting

The fluorescent lamp used in these luminaires has a rated lamp life of 7500 hours. This longer lamp life reduces the cost of relamping luminaires below any other type now used for street lighting.

Features of L-M's New Fluorescent Luminaires

Large light source • Even, cool white color • Minimum glare • Low power consumption • Longer lamp life

Separate efficient reflecting system for each lamp • Good vertical component across the whole surface of the street • Good balance between building and road surface

Two lamp ballasts • Easy accessibility for relamping • Wiring terminal block easily accessible • Ballast can be removed very simply • Bracket adjustable ±5° for leveling.

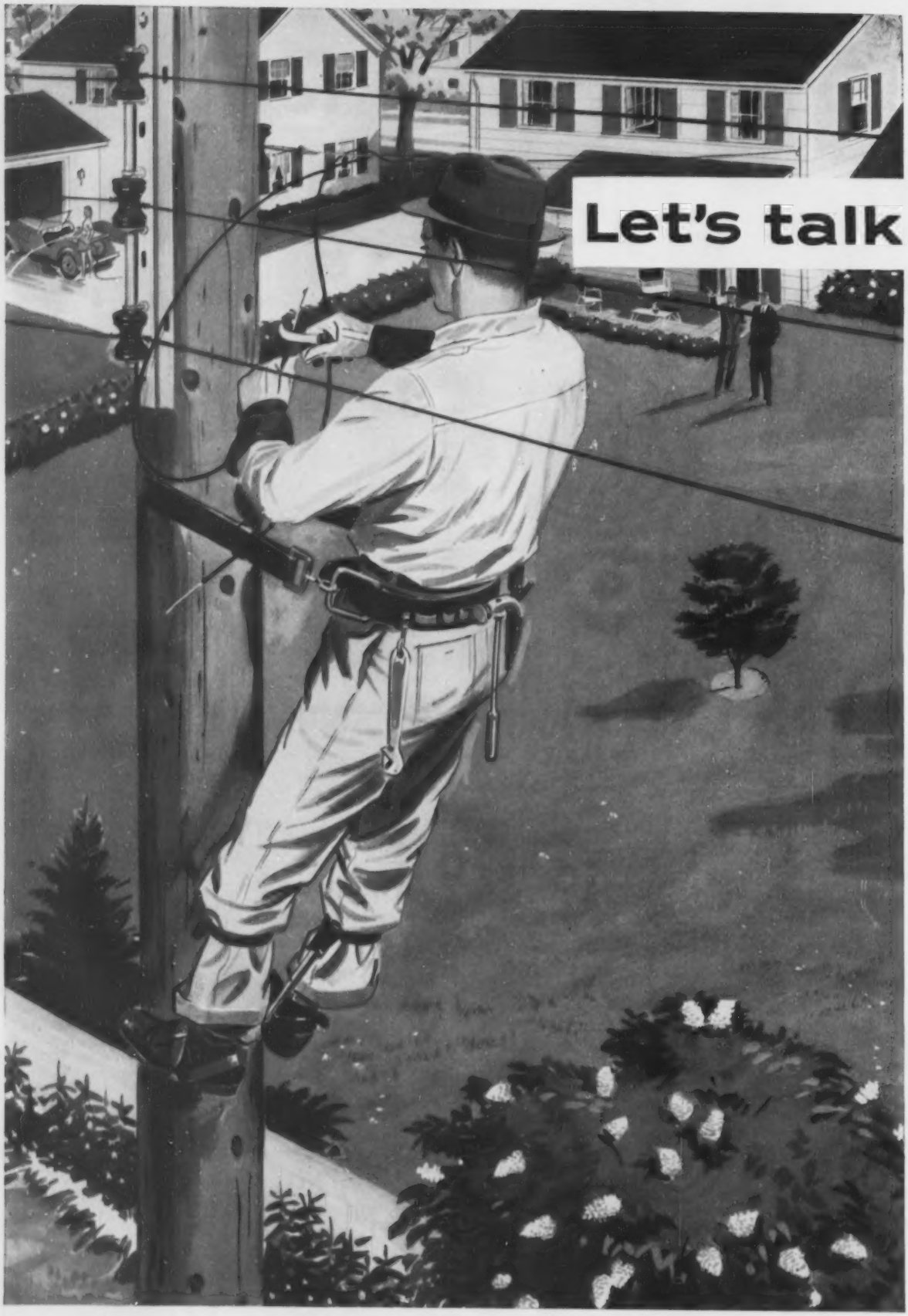
L-M's fluorescent luminaires are easily accessible for cleaning, relamping, wiring terminal block and ballast removal. Four-lamp unit has two ballasts with one tube on either side of the luminaire paired to each ballast. Thus, if one tube burns out, the light output of the luminaire is reduced only 50% in each direction. Also, if desired, two lamps could be switched off for part night circuits.

Get Complete Information

Details of the new L-M fluorescent luminaires are available. Ask the L-M Field Engineer for information, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL

Street Lighting


Let's talk

Alcoa® Aluminum for Distribution Lines

Every day more power systems are using more aluminum for distribution lines. Aluminum has become the most economical metal for power line conductors. The abundant supply of aluminum and Alcoa's technical contributions have helped make this possible. That is why we say, "Let's talk Alcoa Aluminum for distribution lines."

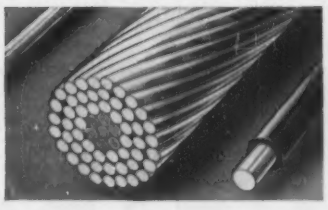
Alcoa's research and development laboratories, test centers and production facilities, responsible for the major advances in aluminum conductors, are working on many distribution problems. Will you bring us yours—for our mutual benefit?

Call your local Alcoa sales office. It's listed under "Aluminum" in your classified directory. ALUMINUM COMPANY OF AMERICA, 2100-H Alcoa Building, Pittsburgh 19, Pennsylvania.

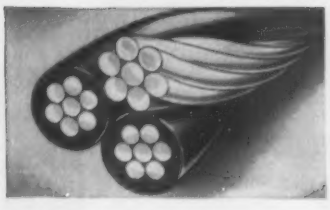
ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

ACSR and All-aluminum Wire and Cable



Covered Wire and Service Drop



Accessories for All Conductors

JOSLYN JUNIOR LUMINAIRES

FOR IMPROVED RESIDENTIAL STREET LIGHTING

Now available in all Standard I. E. S. Light Distributions

- Wedge-band or automatic latching glassware.
- Reflector Glassware Assembly attaches directly to Style 30 and 60 Aluminum heads (Style 60 illustrated), for multiple circuits.
- Adaptable to any Joslyn Style 90 or Style 50 aluminum head—or any Joslyn porcelain head, for series or multiple circuits.
- The Reflector-glassware of the 4-way Type II Luminaire may be rotated for correct alignment with intersection.
- Ask your Joslyn Sales Representative for further details.
- *For complete catalog information, see pages 331-338 of the new Joslyn #17 Catalog.*

AVAILABLE FOR

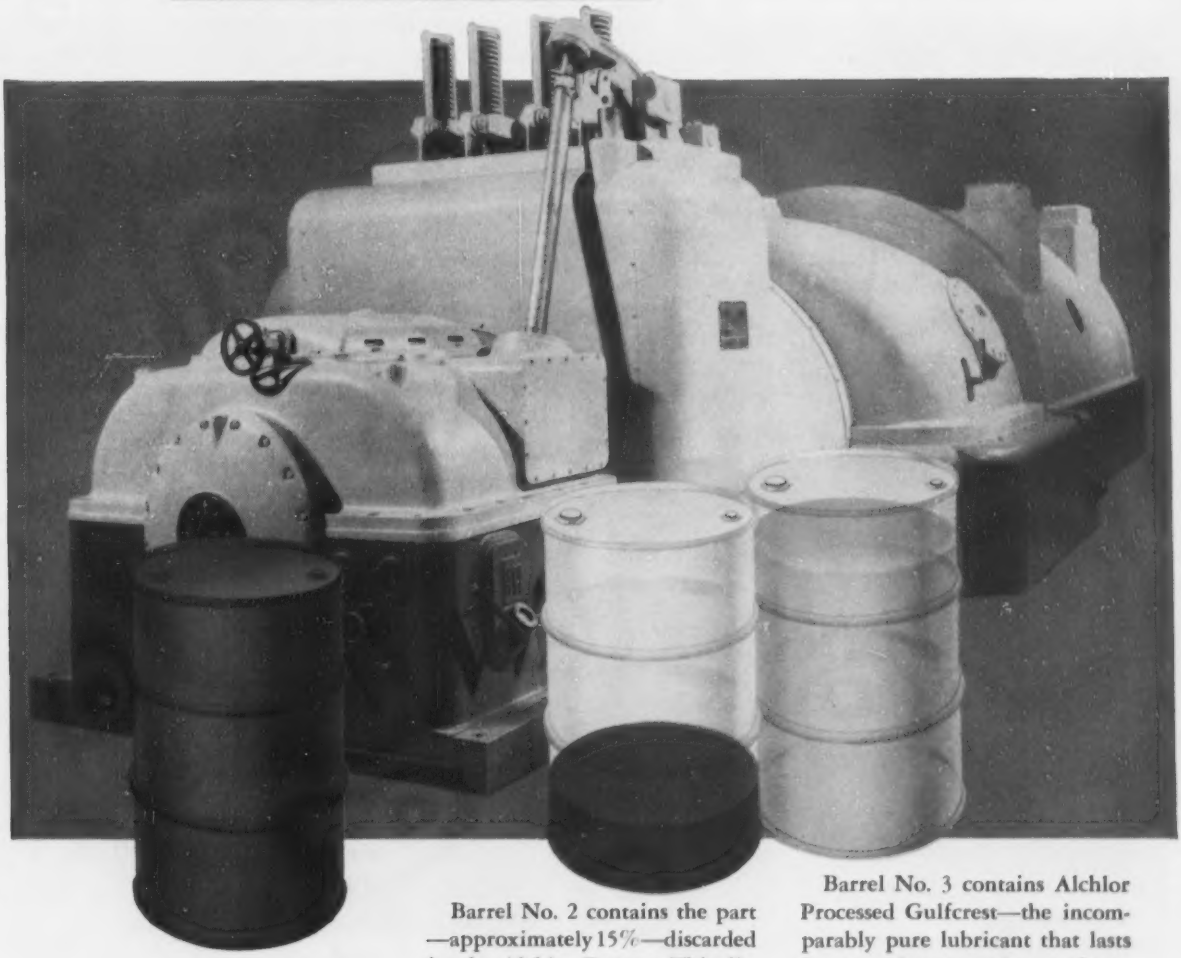
I. E. S. Types I, II, III, 4 way II, IV and V Light Distributions with 1000 or 2500 Lumen Lamps

JOSLYN MFG. AND SUPPLY CO.

***Executive Offices:* 20 N. Wacker Drive, Chicago 6, Ill.**

JOSLYN

GULFCREST *is the only turbine oil that is super refined for superior performance by the ALCHLOR PROCESS*



Barrel No. 1 contains a highly refined oil that will become Gulfcrest. It has gone through the usual steps used in refining other turbine oils—but has not yet been Alchlor Processed.

Barrel No. 2 contains the part —approximately 15%—discarded by the Alchlor Process. This discarded portion contains unstable hydrocarbons which, if allowed to remain in a turbine oil, are likely to oxidize, increase neutralization number, form sludge, emulsifiers, and harmful acids.

Barrel No. 3 contains Alchlor Processed Gulfcrest—the incomparably pure lubricant that lasts longer, gives superior performance and helps keep your turbine systems clean indefinitely. To make Gulfcrest even finer, special inhibitors are added to give it still greater stability and protect against corrosion and foam.

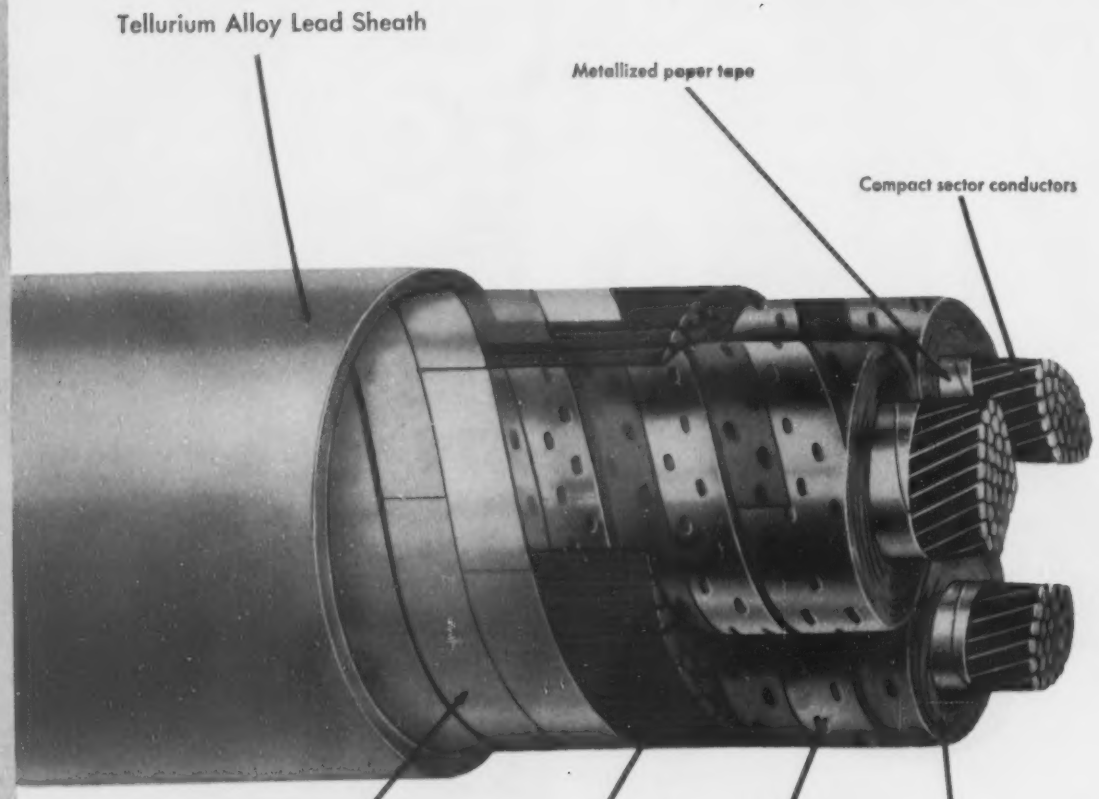
Call your nearest Gulf office today and have a Gulf Sales Engineer recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION • GULF REFINING COMPANY • 1822 Gulf Building, Pittsburgh 30, Pa.

NEW TELLURIUM ALLOY LEAD SHEATH

IT'S A ROEBLING


Tellurium Alloy Lead Sheath
Metallized paper tape
Compact sector conductors
Intercalated paper and bronze tape belting
Saturated paper fillers
Perforated copper tapes over each conductor insulation
Wood pulp paper, oil impregnated

BRINGS 4 BIG ADVANTAGES AND EXCLUSIVE!

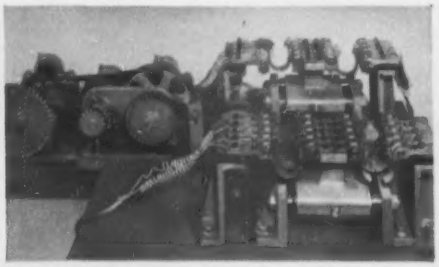
ROEBLING IS NOW READY to fulfill your requirements for Paper Insulated Power Cable with the new Tellurium Alloy Lead Sheath . . . the perfect and *economical* answer to four serious power cable problems.

Tellurium Alloy Lead Sheathed Paper Insulated Cable has a lower long-time creep rate. It has extra high fatigue resistance. This cable has high bursting strength. It has remarkable stability under heat application as in duct splicing and wiping.

In addition, it does away with the need for frequent and expensive segregating stop joints or costly reinforced lead sheaths . . . does not require extra-liberal expansion bends or large manholes . . . its bursting strength is far superior to that of any other cable sheath alloy . . . heat application at joint end wipes and similar locations leaves its desirable properties unimpaired.

Roebling Paper Insulated Cable with Tellurium Alloy Lead Sheath is now in full production. Practical experience has confirmed laboratory findings that this new sheath brings a combination of physical characteristics that assures new measures of performance and unmatched economy.

WRITE US FOR FULL DATA. John A. Roebling's Sons Corporation, Dept. 707, Trenton 2, N. J.



Some of the specially-developed testing equipment with which Roebling maintains quality control of the production of Tellurium Alloy Lead Sheath. (At left) Lead strip fatigue testing at controlled temperature. (At right) Lead strip fatigue testing at room temperature.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. & 5 PITTSBURGH ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATTI, 3253 FREDONIA AVE. • CLEVELAND, 13325 LAKEWOOD HEIGHTS BLVD. • DENVER, 4501 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1930 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • PITTSBURGH, ROOM 339, HENRY W. OLIVER BLDG. • ROCHESTER, 1 FLINT ST. • ST. LOUIS, 3001 DELMAR BLVD. • SALT LAKE CITY, 536 W. 8TH SOUTH ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST. AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, TRENTON 2, N. J.

Poles and crossarms last years longer when protected against decay and insect attack with clean Monsanto Penta.

Penta-treated poles are easy to handle and will not "burn" the hands of workmen. Penta will not bleed or leach out of wood. The protection of this chemical against decay and insects lasts for many years.

Penta cuts costs: Southwestern Electric Service Company recently specified penta-treated Southern Yellow Pine poles for the white-way lighting system in Jacksonville, Texas. For this special installation, poles were hand-picked for straightness, peeled, and coated with aluminum paint. Southwestern reports these wood poles were erected at *one-third the cost* of metal light standards.

FOR A COPY of "Penta for Poles and Crossarms" write: Organic Chemicals Division, Monsanto Chemical Company, Box 478, St. Louis 1, Mo.

MONSANTO
CHEMICALS – PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

PENTA-TREATED CROSSARMS (below), shown being shipped to a customer from one of the 75 treating plants that apply Penta, will outlast untreated members at least 4 to 1.

Simplify those HARD-TO-HANDLE installations with U. S. GRIZZLY Pre-assembled Aerial Cables

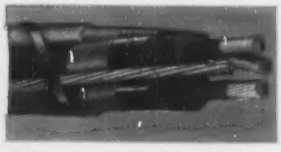
Check the following advantages of U.S. Grizzly® Pre-assembled aerial cables over ordinary open-wiring installations.

1. Less tree trimming is required, and therefore is less objectionable to the community. Can usually be installed in a more direct route.

2. Longer spans and fewer poles due to messenger's great strength.

3. Better appearance because of the elimination of cross-arms and less congestion at the poles.

4. Better service continuity because of high strength supporting messenger.



U. S. Grizzly pre-assembled aerial cable, 15,000 volts. Type RR —3 conductor, Uskor-ona® ozone-resistant insulation — shielded — Neoprene jacket.

5. Better voltage regulation because the conductors are bound closer together.

6. Lower installation and maintenance costs.

7. Permits shorter poles.

8. Made by United States Rubber Company, specialists in electrical insulation, the only electrical wire and cable producer to grow its own natural rubber, make its own synthetic rubber and manufacture its own plastics.

For more information, write to address below.

FREE BOOKLET

Write for your copy of free booklet giving full information about U. S. Electrical Wires and Cables for the Electric Utility Industry.

US RUBBER

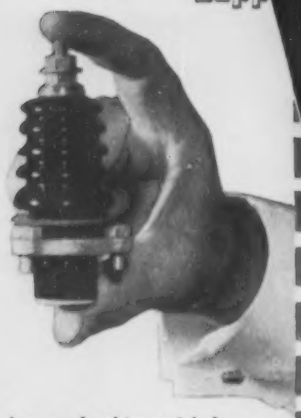
UNITED STATES RUBBER COMPANY

Electrical Wire and Cable Department • Rockefeller Center, New York 20, N. Y.

bushings by Lapp

LAPP INSULATOR CO., INC., LE ROY, N.Y.

Lapp



Small equipment bushing with draw-lead terminal. Flashover: 30 kv dry, 20 kv wet. Similar design available in lower and higher voltage ratings.

Lapp

High-current secondary bushing with non-magnetic mounting adapter for welding to transformer tank. Units available 400 to 2500 ampere ratings.

Lapp

Network transformer bushing, 1400 ampere, with flexible terminal assembly, which provides for outside alignment with network protectors.

Lapp

High-current secondary bushing, 2.5 kv, 3200 amp rating, with integral NEMA spade terminal. Gasketed for pressure sealing.

Lapp

Precipitator bushing, liquid-filled, with spring-loaded sealing. Operates at 70 kv under 50,000 lb. load. Excellent service record for 22 years.

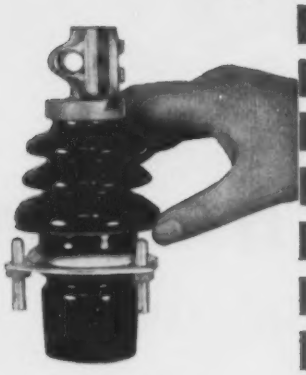
pp

Radio-interference-free special oil-filled bushing for testing equipment. Corona-free, for operating voltages at 25, 50, 100 and 150 kv.

Lapp

Oil-filled bushing, 37 kv, 2000 amp. Spring-loaded sealing; special design for horizontal mounting. In continuous trouble-free service since 1939.

Lapp

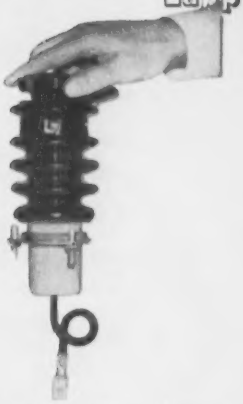


Draw-lead cover-type distribution transformer bushing (NEMA specification). 5 kv to 23 kv ratings. Available with external clamping.

Lapp

Low-voltage secondary transformer bushing—450, 600, 800 amp ratings. External clamping type also available. Gaskets suitable for askarels.

Lapp



Protective-cap sidewall transformer bushing, 8.7 kv. Bakelite knob operates spring-loaded universal (⅛ to 7/16") clamp. Confined gaskets.

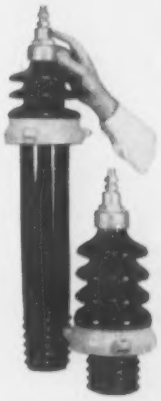
Lapp

Weather-tight entrance bushing of series rated 7.5 to 34.5 kv, 300 to 2000 amps. Terminals available for use with tube, cable, bar.

Lapp

Standard dry-type high-current apparatus bushing, with terminals. Available voltage ratings 5 to 23 kv, current ratings 400-3000 amps.

Lapp



Dry-type apparatus bushings with special modifications—short shank for throat mounting, long shank for lower-than-usual oil levels.

Lapp

Indoor-outdoor bushing, 5000 amp, 23 kv rating. 6" square conductor. Double flange mounting—weatherproof. Other ratings also available.

Lapp

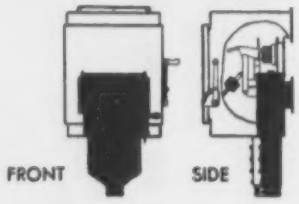
Unusually large (weight 646 lbs.) indoor-outdoor generator lead bushing. High current (7000 amp) 23 kv duty, 9" square conductor.

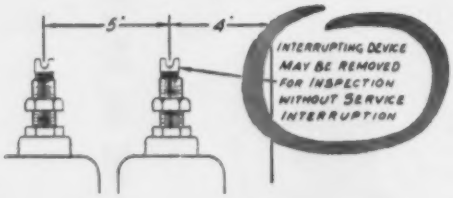
Lapp

Special 3000-amp entrance bushing, designed for minimum outside diameter; conductive-coated for corona freedom. Silver-plated conductor.

3 good reasons why 3E AIR INTERRUPTER ISOLATORS are best for transformer use

In standard procedure normal load of transformer is interrupted by an interlocked secondary breaker leaving only magnetizing current in primary circuit to be broken. The Interrupter ISOLATOR is ideal for such applications.





1 SAVES SPACE

The Air Interrupter ISOLATOR is neat and compact, occupying only one-fourth of the space required for other types of interrupting equipment.

Diagram shows space saved by superimposing a three pole, single throw, 400 ampere, 5000 volt Air Interrupter Cable ISOLATOR, with throat for transformer mounting, over equivalent air interrupter switch. Ratio is approximately 4 to 1 in favor of ISOLATOR.

2 SIMPLE TO INSTALL and MAINTAIN

Air Interrupter ISOLATORS are lighter; consequently they can be handled more easily by construction crews.

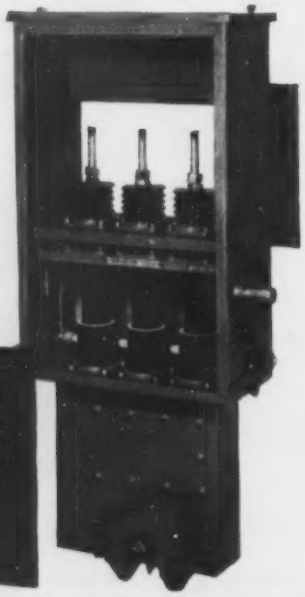
The interrupter units can be removed for inspection by means of a hot stick without clearing the circuit.

For complete data ask for new Bulletin 138.

3 ECONOMY . . . 3E PERFORMANCE EQUALS COSTLIER EQUIPMENT

The Air Interrupter ISOLATOR will provide safe interruption at much less cost than interrupter switches or other approved devices. These ISOLATORS are built for loads up to 15,000 volts . . . and their cost is surprisingly low.

CABLE ISOLATOR
3 pole, single throw
400 Ampere, 15,000 volts.

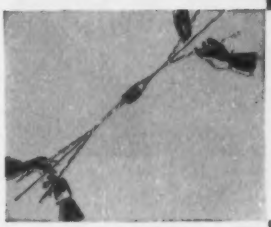


THREE E ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILLINOIS

GUY-GRIPS COST LESS

per pound of tensile strength

per year of service life



PREFORMED "GUY-GRIPS" are the fastest, most economical and most efficient means of dead-ending guys. They eliminate the need for clamps and ARE INSTALLED BY HAND. Since they cannot slip whether they are dead-ending a 2,000-pound, solid-wire guy or a 40,000-pound, ⅜" EHS steel guy, no retightening is ever necessary.

One large Utility has found that Preformed "Guy-Grips" save 50% on labor and 20% on material. Another assembles and installs a complete Preformed Guy Assembly (4 dead-ends) in the same time it used to take to assemble just one 3-bolt clamp.

PREFORMED "GUY-GRIPS" are proving definitely throughout the Country that they assure:

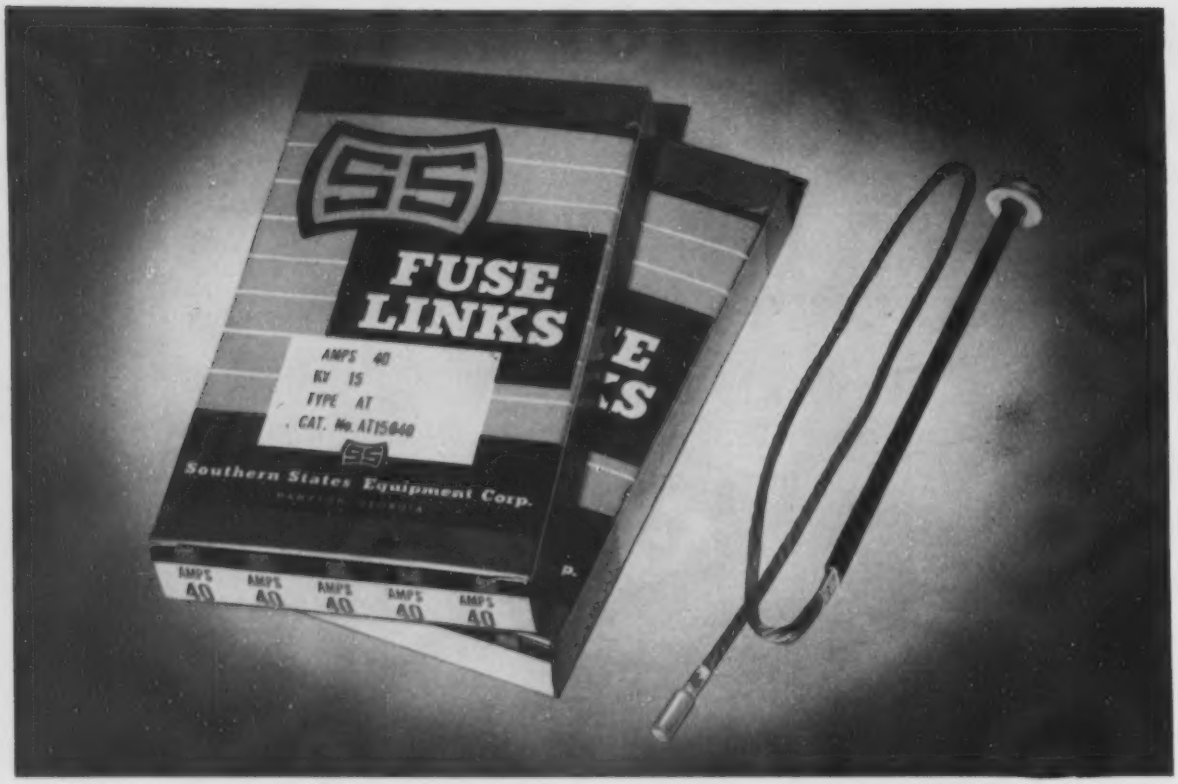
Maximum
- Corrosion Life
- Installed Tensile Strength
- Fatigue Characteristics
- Impact Strength
- Neatness in Appearance

Available in aluminum, copper, bronze (various grades including calsun), copperweld, stainless steel and galvanized steel, PREFORMED "GUY-GRIPS" assure the longest satisfactory guy life.

For complete details of their exclusive advantages, write, or telephone Cleveland: EXpress 1-3571.

PREFORMED LINE PRODUCTS CO.

5349 ST. CLAIR AVE. • CLEVELAND 3, OHIO



SOUTHERN STATES NEW AK AND AT LINKS ASSURE PROTECTION ON RESTRICTED FAULTS

Southern States Types AK and AT Fuse Links, which meet EEI-NEMA standards, employ a principle that provides complete dependability in clearing restricted overloads, as well as high short-circuits.

This new arc-quenching ability at overload currents is a standout feature of these Southern States links. It is accomplished through the use of boric acid powder located in intimate contact with the arc of a rupturing link. The mass of boric acid volatilizes, instantly building a vapor pressure high enough to quench the arc. In addition, the high vapor pressure expels the lower end of the fuse link at a velocity far greater than with a conventional spring.

Southern States AK and AT are universal type fuse links and are easily adapted to fit any double vented cutout from 5 KV through 17 KV. Simply remove the screw on button head, cut the flexible cable, and screw the two threaded ferrules together. The result is a double pigtail link as required in double vented fuse holders.

These new links have such features as silver plating of all external metal parts ... high strength crimped joints ... low melting temperature elements ... moisture-proof auxiliary tubes ... and dual element construction providing low melting temperature coupled with high surge stability. The links are highly resistant to corrosion and more dependable mechanically and electrically than ever before.

It will pay you to specify Southern States AK and AT Fuse Links with their multiple advantages.

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

Vacuum dried, oil impregnated crepe paper

NOW IN PRODUCTION AT IRVINGTON!

Your requirements for crepe paper insulation can now be supplied by Irvington — the *leader* in electrical insulation.

Crepe paper and oil are degasified under very high vacuum to assure freedom from moisture and provide good electrical properties.

The paper is packaged in cans to meet your specific requirements for number and size of rolls. Roll sizes include ½" x 4 yards, 1" x 4 yards, 1" x 18 yards, 1" x 36 yards. Cotton yarn and copper mesh can also be included.

Use Irvington Crepe Paper on your low- and medium-pressure gas-filled cable — and also on oil-filled and pipe-type cable.

Look to
IRVINGTON
for Insulation Leadership
INSULATING VARNISHES
VARNISHED CAMBRIC
VARNISHED PAPER
VARNISHED FIBERGLAS
INSULATING TUBING
CLASS "H" INSULATION

Other IRVINGTON Insulations for Utilities

Harvel Oil Stop 621 • Fibron® Plastic Tape • Temflex® 105 Tape • No. 32 Red Enamel

IRVINGTON VARNISH & INSULATOR

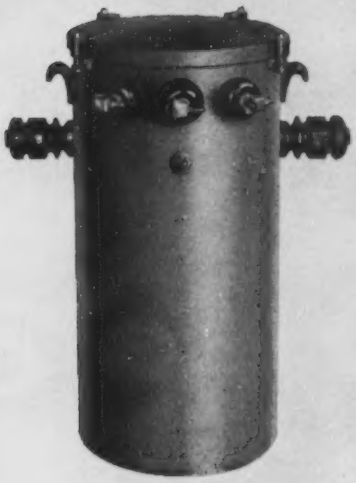
DIVISION OF MINNESOTA MINING & MANUFACTURING COMPANY

21 ARGYLE TERRACE, IRVINGTON 11, N. J. • PLANTS: IRVINGTON, N. J.; MONROVIA, CALIF.; HAMILTON, ONTARIO, CANADA

● If transformer failure keeps your linemen busy removing distribution transformers and installing new ones, then it's time to investigate Standard Transformers as a solution to your problem. Once a Standard Distribution Transformer is installed on a line, it's there to stay . . . silently channeling current to your customers.

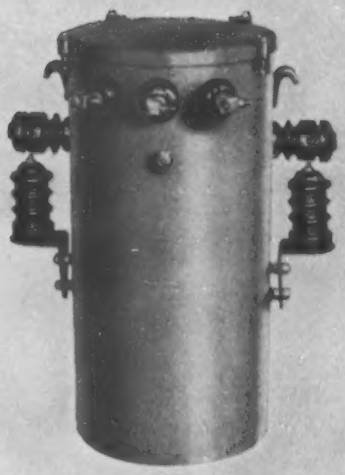
What makes Standard Distribution Transformers such dependable "watch dogs"? Close examination discloses sound, basic construction in full accordance with ASA and REA standards. Outstanding features set them apart from others as an indispensable and integral part of your distribution system. Covers are moisture-proofed with Neoprene gaskets which prevent oil leakage. They can be easily and quickly removed, allowing immediate access to vital parts. A rugged, copper-bearing steel tank houses the low-loss core assembly of non-aging, varnish-coated, silicon steel sheets. Specially designed core clamps hold core rigidly in place assuring quiet, trouble-free operation. These, plus numerous other construction features, demonstrate Standard Transformers to be helpful in solving your excessive maintenance problem.

Naturally, you want more information concerning Standard Distribution Transformers than that which we have presented in these limited words. Your nearby Standard Transformer representative has answers to your questions. Call him. Let him show you how Standard Distribution Transformers can help you maintain the excellent service your customers deserve.

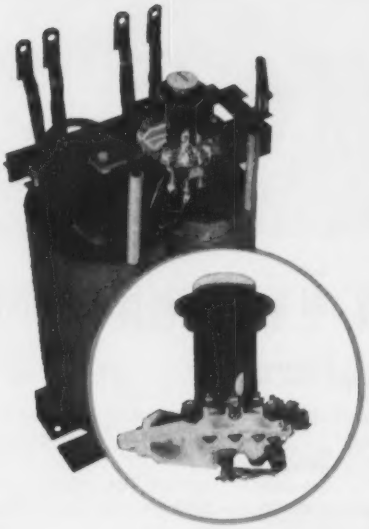


Type A. OISC Conventional Distribution Transformer, 15 KVA, single phase, 60 cycle, with side wall mounted high voltage bushings. Standard construction for voltages 5 KV and sizes through 100 KVA.

Type CSP. OISC Distribution Transformer, 15 KVA, single phase, 60 cycle, with primary lightning arresters, internal fuses, low voltage circuit breaker and side wall mounted high voltage bushings. Standard construction for voltages 5 KV and less and sizes through 100 KVA.



TRANSFORMERS ARE A
YOUR DISTRIBUTION SYSTEM

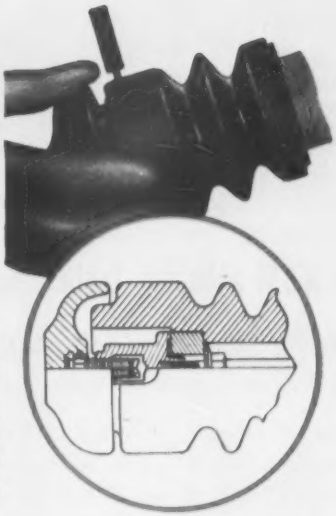


NEW TANK WALL BUSHINGS →

New bushings permit "flick-of-the-wrist" line insertion without tools. No live parts are exposed. Terminal compression stud keeps easy-to-grip, insulated porcelain cap from falling off when unscrewed to receive primary leads. Cables can be brought in from either side and held securely by pressure from the clamping shoe. Makes for faster, safer, easier installations.

← TAP CHANGER SWITCH

Standard's new Tap Changer Switch embodies a contact-making assembly with a brass wheel for positive contact. Normal settings are with 4-tap voltage section. 2½ % taps within 10 % range of normal rating. Standard supplies transformers with 4 taps above or below, or half above and half below as specified by the customer. This is available at no extra cost to you. Contact-making points are submerged in oil with the handle well above oil level.

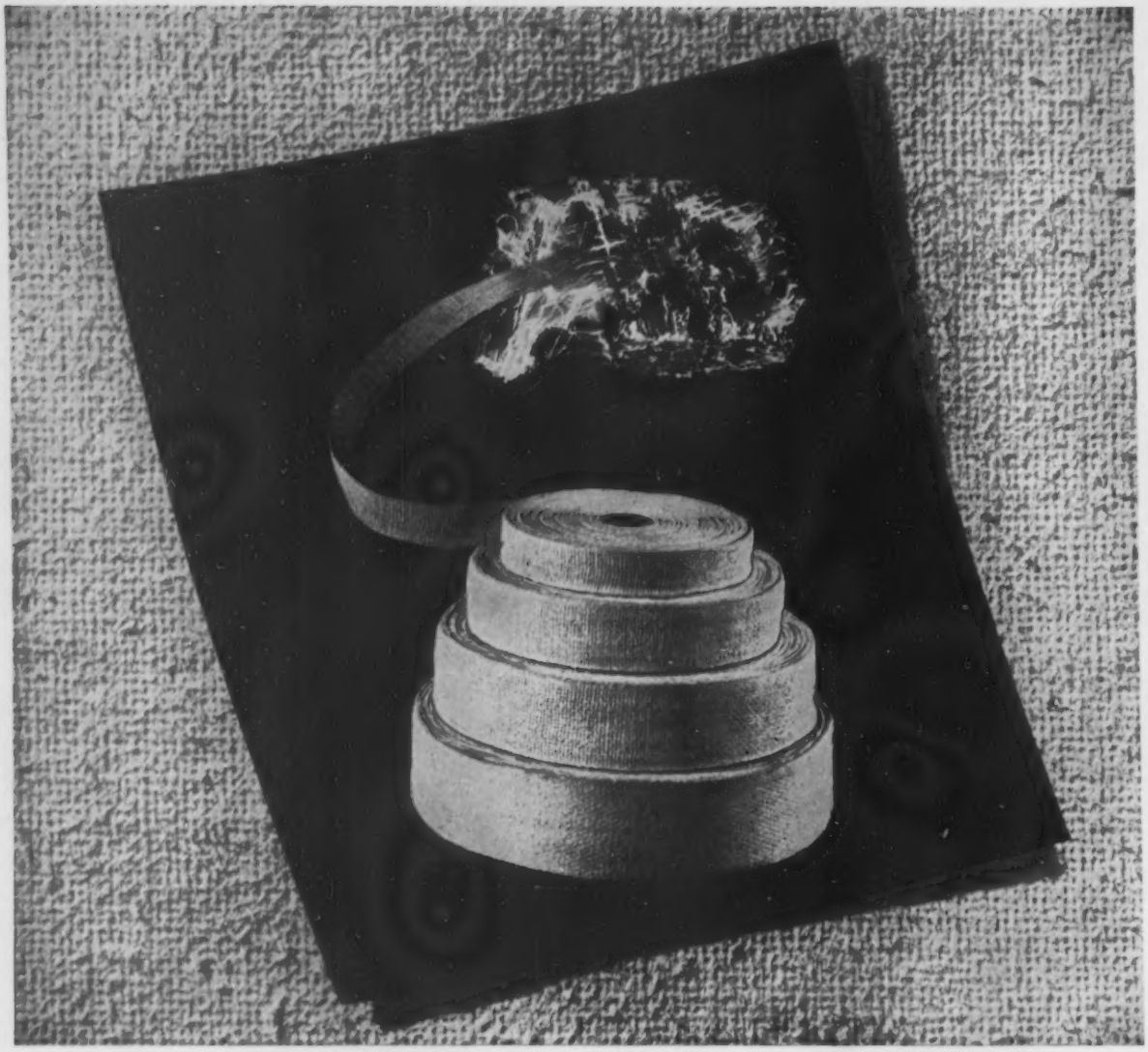


Standard

THE STANDARD TRANSFORMER COMPANY

Trade Mark ®

WARREN, OHIO
REPRESENTATIVES IN PRINCIPAL CITIES



Specify K&M asbestos textiles for the highest quality and dependable performance

Asbestos, a product of nature, is the only inorganic mineral fiber which can be carded, spun and made into textiles.

Keasbey & Mattison Asbestos textiles are made with only the finest grades of asbestos fiber. They're known for their uniformity of weave and thickness. That's why the electrical industry—manufacturers, contractors and central stations—has come to rely on K&M Asbestos textiles.

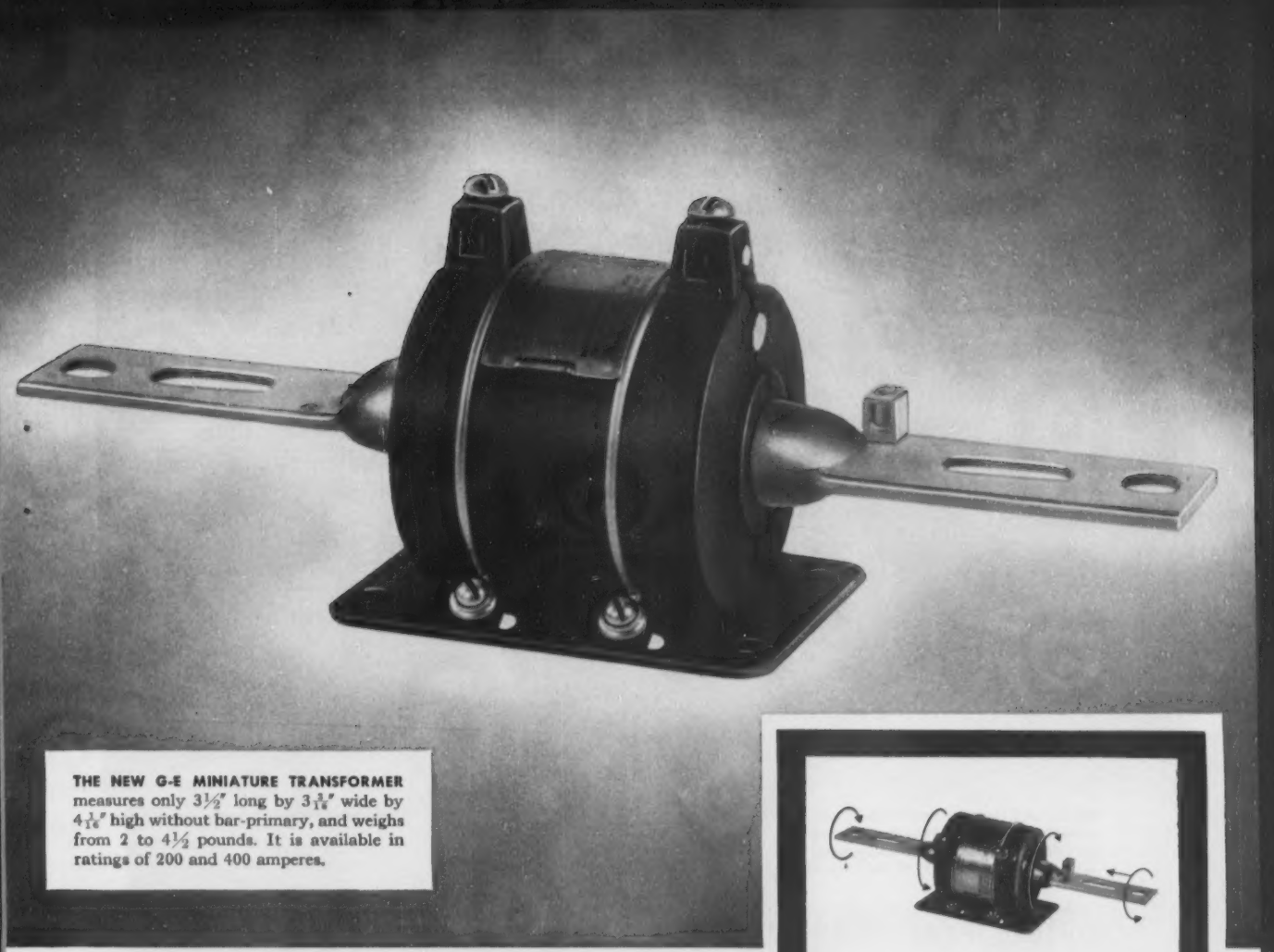
K&M Asbestos textiles are available in many different forms . . . roving, yarn, thread, tapes, cloth, tubing, wick packing, twisted and braided rope packing, and safety garments. All of these textiles are made with the greatest care for maximum uniformity and fidelity to specifications.

Be sure to contact K&M for the answer to your insulating problem. Remember that K&M has more than half a century of research and development experience, backing up these high quality asbestos textiles. Write for complete information today.

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

IN CANADA: ATLAS ASBESTOS COMPANY, LTD., MONTREAL, TORONTO, WINNIPEG, VANCOUVER

Nature made asbestos . . . Keasbey & Mattison has made it serve mankind since 1873



THE NEW G-E MINIATURE TRANSFORMER measures only $3\frac{1}{2}$" long by $3\frac{3}{16}$" wide by $4\frac{7}{16}$" high without bar-primary, and weighs from 2 to $4\frac{1}{2}$ pounds. It is available in ratings of 200 and 400 amperes.

GENERAL ELECTRIC ANNOUNCES . . .

New Butyl-molded Miniature Current Transformer

General Electric's butyl-molded current transformer line has been extended to include a 600-volt miniature. The new Type JCA-0 features complete mounting flexibility. Designed for indoor or outdoor metering applications, the new miniature is available in 200- and 400-ampere ratings in both bar-primary and window-type construction.

MOUNTING FLEXIBILITY is provided in the Type JCA-0 first by friction-fit primary terminals. These terminals are adjustable within a 360-degree arc and can also be moved lengthwise. Also the removable base plate can be rotated within an arc of 180-degrees in relation to the secondary terminals.

INDOOR OR OUTDOOR APPLICATION is another feature of the Type JCA-0. Because of its butyl-molded construction, this new transformer can be installed either indoors or outdoors, and requires no housing or other protection from the weather.

SIX VARIATIONS of this butyl-molded current transformer are possible. It can be used as a bar-primary-type or window-type, or with or without base plate and an auxiliary mounting plate.

FOR MORE INFORMATION, contact your nearest G-E Apparatus representative, or write for bulletin GEC-1245 to: Section 604-41, General Electric, Schenectady 5, N. Y.

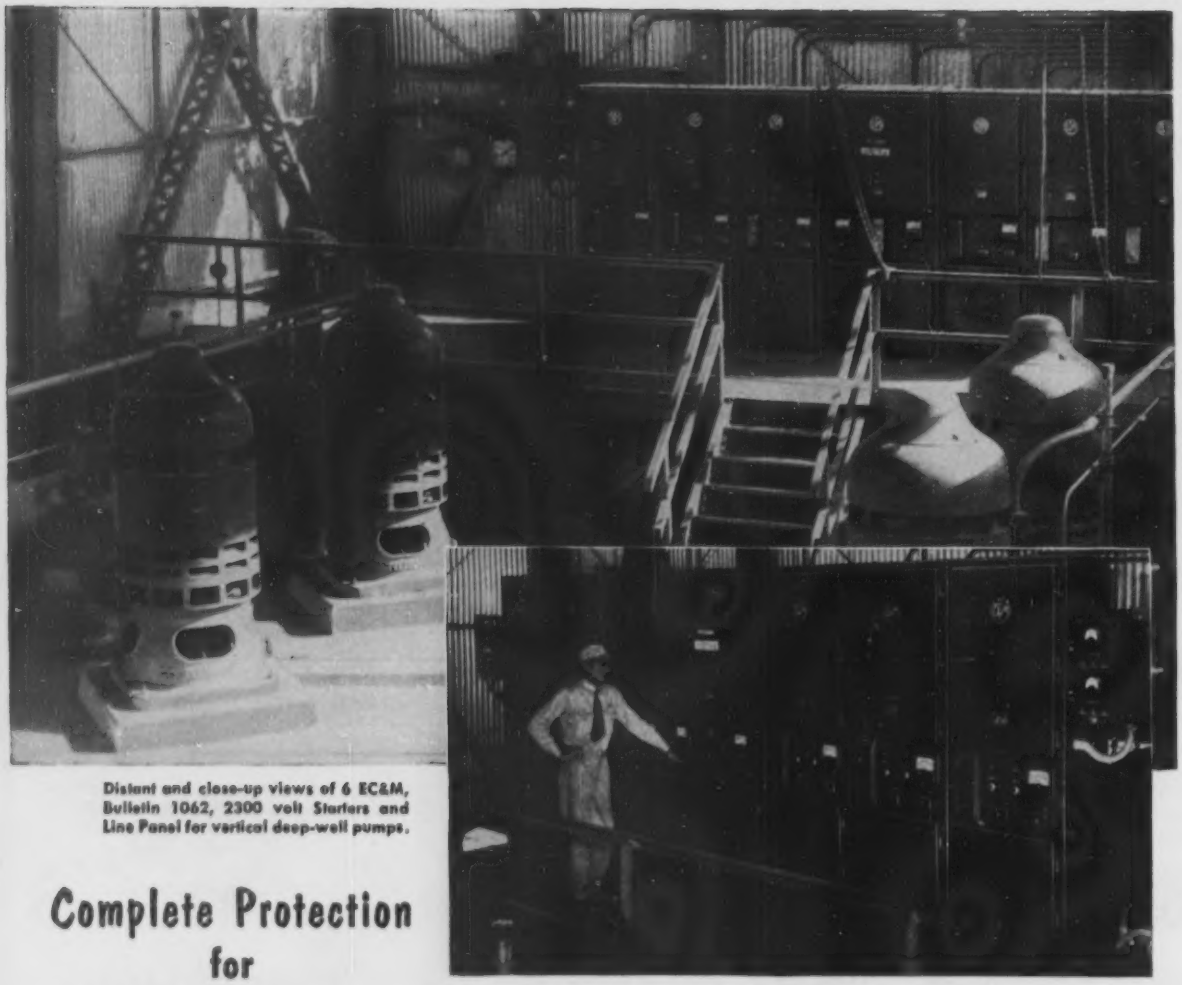
GENERAL ELECTRIC

BAR-PRIMARY-TYPE

Complete adjustability is available in the new transformer. The primary and secondary terminals may be adjusted and set independently of each other. This flexibility provides mounting in any position.

WINDOW-TYPE

The new Type JCA-0 transformer is also available in a window-type construction for through-type applications. This feature plus the butyl-molded construction facilitates outdoor pole mounting installations.



Distant and close-up views of 6 EC&M, Bulletin 1062, 2300 volt Starters and Line Panel for vertical deep-well pumps.

Complete Protection for ESSENTIAL DRIVES BY EC&M 2300 VOLT STARTERS

WRITE FOR BULLETINS 1062 and T9-117 reprint.

When plans call for 2300 volt power, the motor drives connected to this source take on added importance—they are generally considered "main-line" and highly essential to a plant's output. Such drives deserve "all-out" protection and EC&M Type ZHS 2300-4600 volt Motor Starters are designed to provide it.

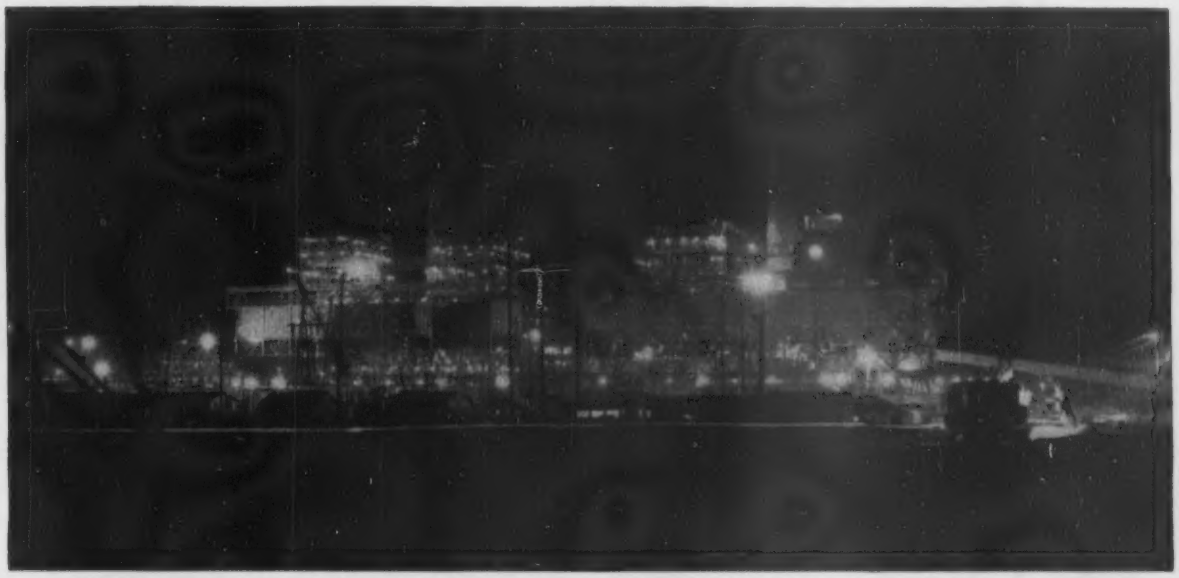
Illustrated above is a typical installation of these EC&M Starters. Main line contactor is the well-known Type ZHS Magnetic Contactor having high interrupting capacity—ability to provide frequent starts and stops with only routine inspection. Front cubicles are the aligning type; self-contained bus is an optional feature. Safety door interlocks open the contactor circuit and avoid pulling disconnect switches under load. Push button starting brings each motor up to speed with greater skill than human hands could do it.

When making initial cost estimates, get the facts on EC&M High Voltage Starters. Our nearby office will be glad to supply full information on starters which give complete protection.

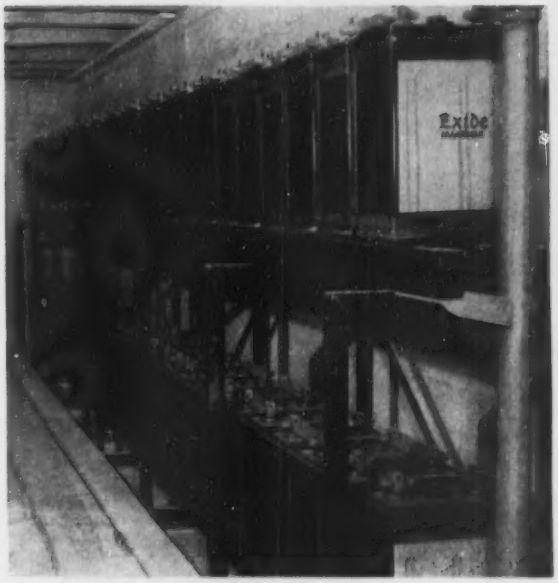
THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

ASSURE AMPLE POWER FOR SWITCHGEAR OPERATION

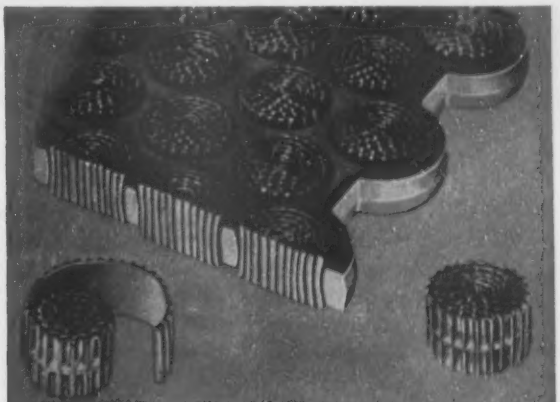
. . . with dependable Exide-Manchex batteries!



THE ATOMIC ENERGY COMMISSION'S Paducah Area Project demands a tremendous supply of power, about half of which is furnished by the Joppa, Ill., Steam Electric Station of Electric Energy, Inc. Dependability of all equipment is the prime requisite. It is significant that the four boiler and turbine units at this vital station, generating 650,000 kw, rely on Exide-Manchex batteries for *positive operation* of switchgear at ample voltage. Instant power for all other control circuits and for emergency lighting is assured. In addition, lower costs for operation, maintenance and depreciation make Exide-Manchex *your best battery buy* for all control and substation services!



HERE ARE HALF of the two 120 cell FME-15 Exide-Manchex batteries installed at the Joppa Station. Assure dependable power, easy maintenance (water is needed only about twice a year) by buying Exide-Manchex batteries. For full details, call your Exide sales engineer—write for form 5001 (Engineering and Maintenance Manual).



THE POSITIVE PLATES are the heart of any battery. Only Exide-Manchex have the famous manchester positive plates with buttons of active material. These buttons, inserted in a strong alloy grid, assure you of *high capacity* in a compact space, with an unusually long battery service life.

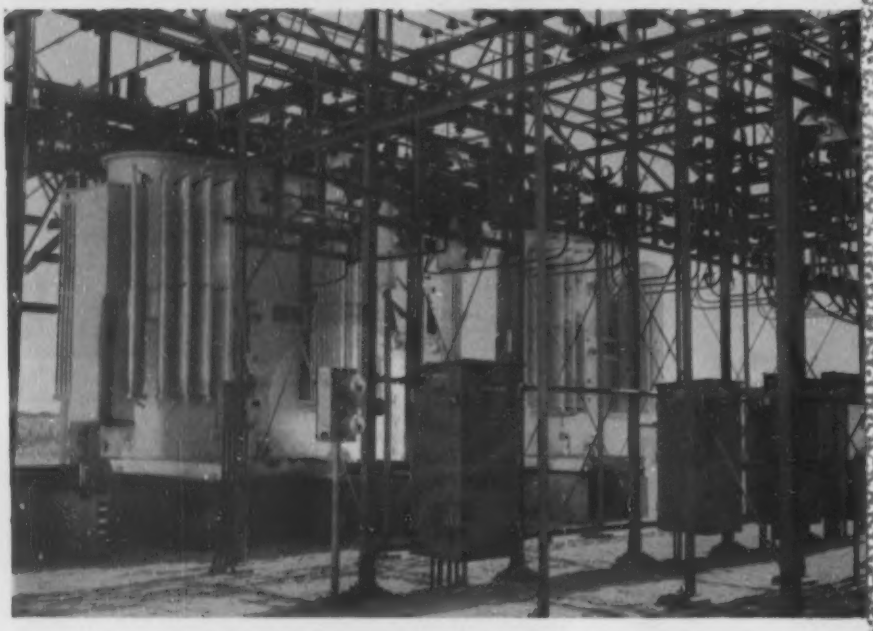
Your best battery buy
. . . for all control and substation services

Exide®
MANCHEX® BATTERIES

Exide INDUSTRIAL DIVISION, The Electric Storage Battery Company, Philadelphia 2, Pa.

Get complete load information

the inexpensive way...
with Lincoln Demand Meters



Know your feeder capability

Exact knowledge of your system through *measurement* is absolutely necessary if you are to utilize capacity most efficiently.

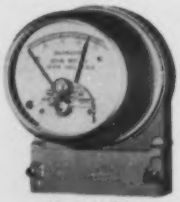
Lincoln "Indicating Meters with a Memory" are an inexpensive means of obtaining continuous measurements on feeders, in substations, or on the distribution system.

- **Type AD Ampere Demand Meter lets you find the current balance.**
- **Type V-2S Minimax Voltmeter provides continuous information on both the minimum and maximum voltages at point of installation.**
- **With Type VARS, full data on reactive lead and lag is made available.**
- **Type WD gives similar information on your demand in kilowatthours.**

All these "Indicating Meters with a Memory" have similar counterparts in graphic meters.

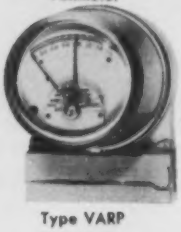
Have you received your copy of "Solving Distribution Problems through Measurement"? There's one for you—available on your request.

Type ADS Ammeter



Type WDP Wattmeter

Type V-2S Voltmeter



Type VARP Kvar Meter

Service Type Socket Mounting Graphic

Switchboard Semi-flush Graphic

Bottom Connected Graphic

Indicating Meters with a Memory

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

SM54-2

for time-saving, money-saving

POWER DISTRIBUTION

SQUARE D
TOTALLY ENCLOSED FEED-IN DUCT

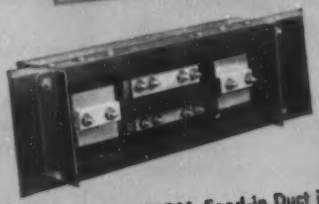
is the most efficient way to transmit large amounts of power. It provides the lowest known voltage drop—only 1.8 volts per 1000 amperes per 100 feet.

Exclusive design requires no ventilation—permits a totally enclosed, compact, dust-excluding enclosure. Rigid construction provides high resistance to heavy electrical stresses.

SQUARE D
EXPANSION CONNECTED PLUG-IN DUCT

provides flexible power distribution for branch circuits. Machinery can be rearranged quickly at minimum cost. Plug-in units can be attached at frequent intervals along the length of the duct, providing power where it's needed, when it's needed.

BUSWAY FEATURES PROVE DESIGN LEADERSHIP



NEW JOINT DESIGN. Feed-in Duct joint design saves installation time and reduces maintenance cost. Duct ends are identical—unnecessary to select mating ends before positioning or hanging duct sections. Outward-facing, pre-installed bolts permit rapid assembly and easy maintenance.

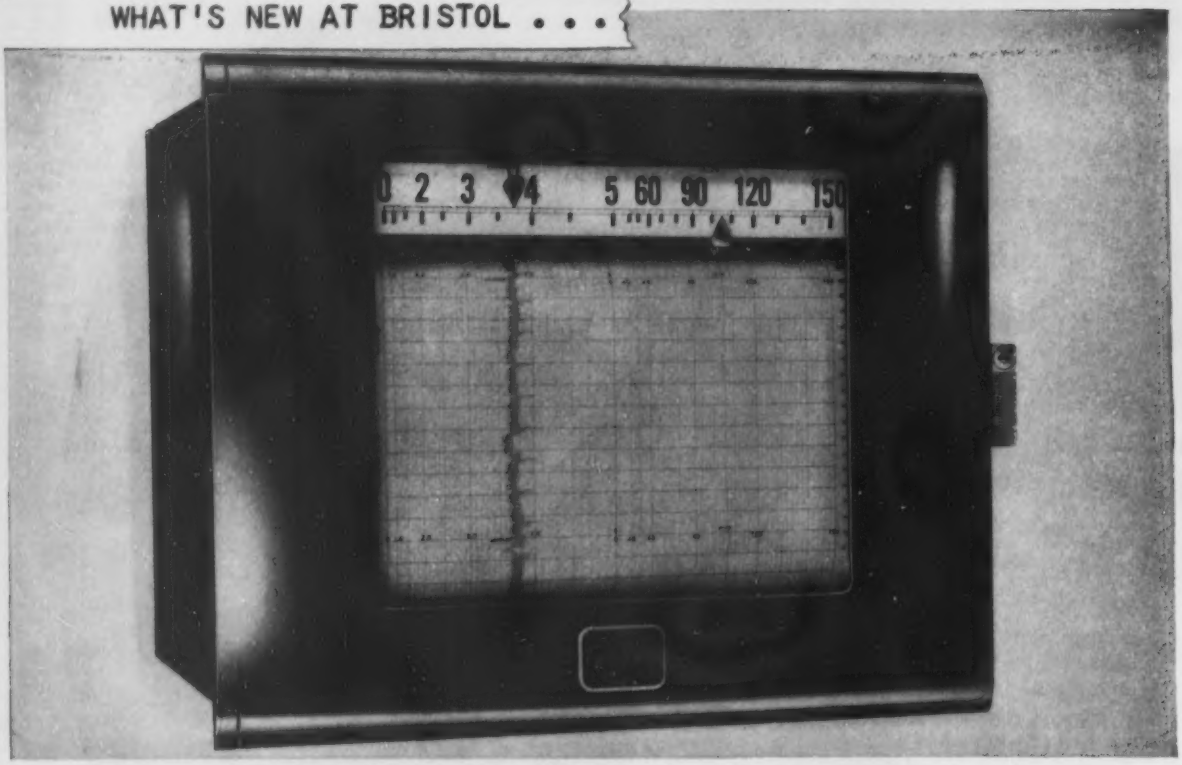
ROUND BUS BARS for Plug-in Duct provide greater mechanical strength and resistance to short-circuit stresses. Circuit breaker or fusible type plug-in units are easily installed at 2-foot intervals along both sides of the duct. Plug-in stabs grip the round bus bars with exceptionally high pressure.

EXPANSION CONNECTORS of laminated copper join bus bars between sections—permit proper alignment, insure tight joints and provide for expansion and contraction at Plug-in duct joints. All bolt heads face outward for greater accessibility.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

WHAT'S NEW AT BRISTOL . . .



Record current and voltage on one chart

with Bristol's Electronic Dynamaster Recording Voltmeter-Ammeter

THERMAL CURRENT and thermal voltage converters used with the Dynamaster Recording Voltmeter-Ammeter.

This two-pen strip-chart potentiometer records voltage and current simultaneously on the same chart. Measurements are made from a thermal voltage converter and a thermal current converter — a-c/d-c transducers with extremely high response speeds.

Here's what you get in this voltmeter-ammeter:

Accurate measurement: The Dynamaster is an accurate electronic instrument of simple, rugged construction. It is well suited for central station use under severe operating conditions, as well as for research and laboratory use.

Fast response: 2 seconds for full range pen travel. Every variation is recorded. Measurement is continuous.

Improved chart record: Two-zone, 12-inch strip chart with 11-inch calibrated width. Records are side-by-side — easy to read and compare, with expanded scales in the operating ranges. Chart speeds from ¾-inch per hour to 4-inches per second.

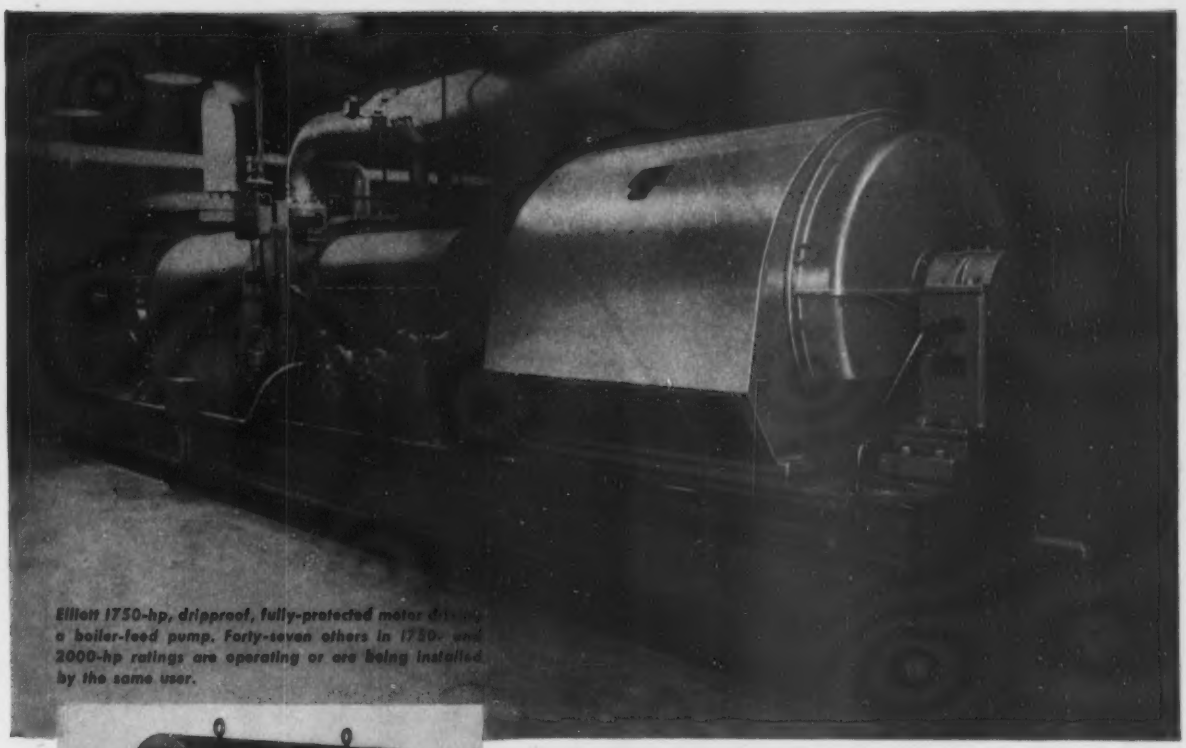
Kilowatt and Kilovar recorder: The Dynamaster is also available, using Bristol Thermoverter Transducers (thermal watt converters) as the primary elements, for recording watts and vars on a single two-zone chart.

Write for more information to The Bristol Company, 116 Bristol Road, Waterbury 20, Conn. 4.31

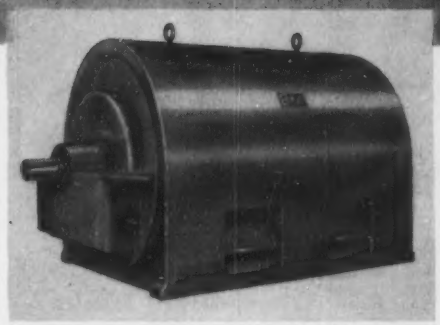
BRISTOL

POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION

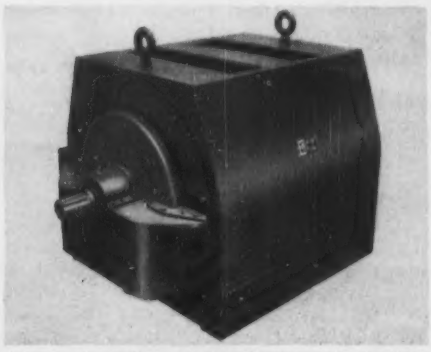
AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS



Elliott 1750-hp, dripproof, fully-protected motor d[illegible] a boiler-feed pump. Forty-seven others in 1750- and 2000-hp ratings are operating or are being installed by the same user.



Elliott two-pole induction motors, 350-4000 hp, are also available with bracket-type bearing construction.



This top air discharge design illustrates the flexibility of Elliott two-pole motor design.

83-23

Elliott FABRI-STEEL MOTORS AND GENERATORS

48 large two-pole

ELLIOTT MOTORS

for one user!

When one power generating system purchased 48 of these large, two-pole motors to drive boiler-feed pumps, it was another case of demonstrated confidence in Elliott motor design and construction.

These motors have proven themselves with their exceptionally high efficiency and power factor. With their Fabri-Steel construction, the frame members are joined by the latest welding techniques. This results in high strength and rigidity with light weight. The rigid welded stator frame and bearing bracket construction reduce vibration and noise and maintain uniform air gap. Every motor element reflects this careful engineering and workmanship. Get all the facts in Bulletin PB 7000-1-151. Write Elliott Company, Ridgway, Pa.

ELLIOTT Company

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS • CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

RIDGWAY DIVISION

FOR MOTORS 1-200 HP: CROCKER WHEELER DIV. AMPERE, N. J.

Four-wheel-drive INTERNATIONALS provide new standards of efficiency and stamina for a wide variety of public utility jobs. Shown is an R-160 (4x4) with service-utility body, winch, and pole setting equipment.

MEET MISTER 4X4!

INTERNATIONAL four-wheel-drive trucks bring to public utility operators entirely new 4x4 performance and efficiency. These new four-wheel-drive trucks combine famous INTERNATIONAL stamina, long life, and operating economy with everything that's new and best in 4x4 design.

A two-speed transfer case affords eight forward and two reverse speeds, permitting movement of men, tools, and equipment over all kinds of terrain. *Two transmission power take-off openings allow operation of front-mounted winch, hydraulic hoist, or other auxiliary equipment. There is provision for mounting a third power take-off on the transfer case.*

INTERNATIONAL 4x4 trucks have everything it takes for tough public utility assignments, plus extra easy steering and handling, famous driver-designed Comfo-Vision cabs. Study the extra-value facts shown here, then get complete details from your INTERNATIONAL Dealer or Branch.

INTERNATIONAL HARVESTER COMPANY • CHICAGO

America's Finest Four-Wheel-Drive Trucks

Two chassis models: Model R-140 (4x4), 130- and 142-inch wheelbases, GVW rating, 11,000 pounds. Model R-160 (4x4), 154- and 172-inch wheelbases, GVW rating, 15,000 pounds.

All-truck power: Both models powered by famous INTERNATIONAL Silver Diamond engines.

Transmission: Sliding gear selective type. Four speeds forward, one reverse. Power take-off openings on right and left sides.

Transfer case: Two-speed declutching type, providing eight forward and two reverse speeds, with manual disengagement of front axle for normal two-wheel-drive operation. Three-position shifting —high, 1.00 to 1; low, 1.87 to 1; and neutral. Provision for mounting full torque power take-off at rear of input shaft.

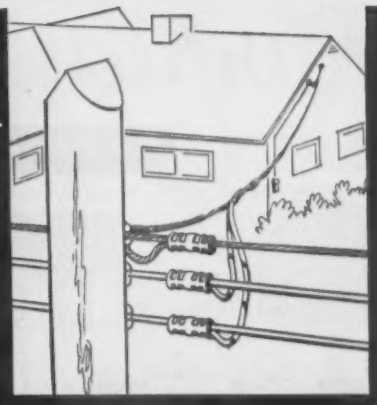
International Harvester Builds **McCORMICK**® Farm Equipment and **FARMALL**® Tractors...Motor Trucks...Industrial Power...Refrigerators and Freezers

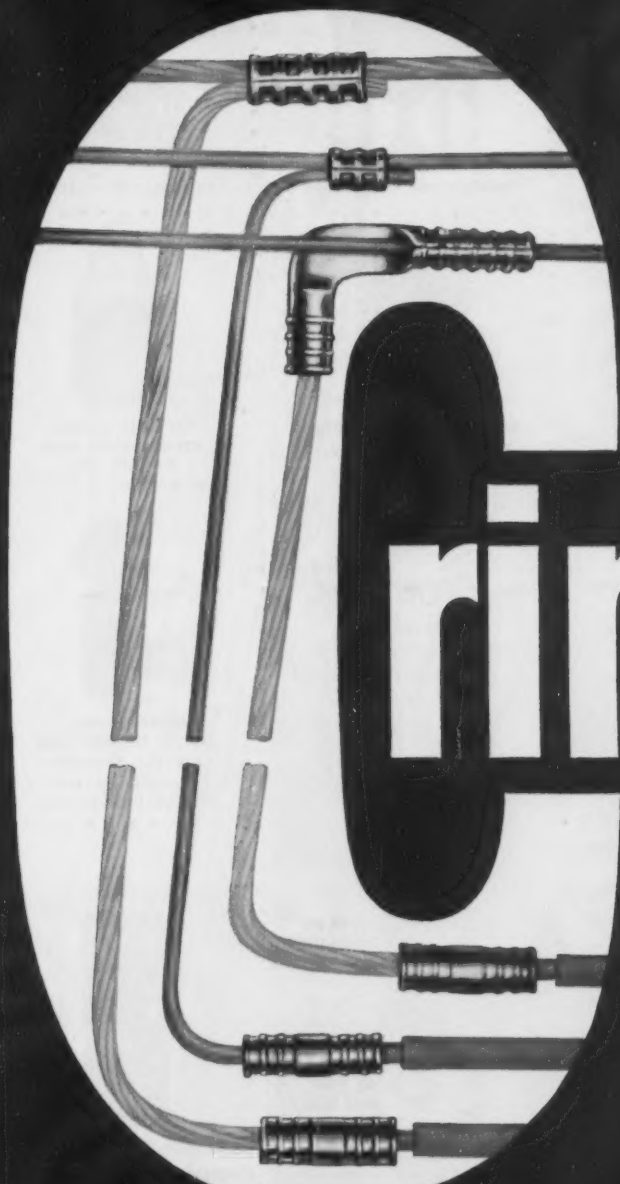
Better roads mean a better America

INTERNATIONAL® TRUCKS

"Standard of the Highway"

from pole to house entrance...





CORROSION FREE

Crimpit

COMPRESSION CONNECTIONS

Simplified hand or hydraulic installation tooling insures fast, fool-proof, economical connections with minimum investment in tools and dies. Write for Bulletin CR.

BURNDY

54-16

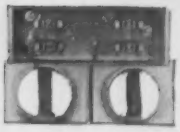
NORWALK, CONNECT. — TORONTO, CANADA • *Factories:* NEW YORK, CALIF., TORONTO • *Export:* PHILIPS EXPORT COMPANY

Murray

Quality Equipment — serving the electrical industry for over half a century.

METERING EQUIPMENT

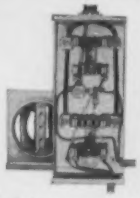
ROUND METER SOCKETS
10 types available.



SOCKET METER TROUGHS
Indoor gangable.

SOCKET METER TROUGHS WITH AND WITHOUT HUBS

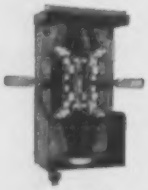
Raintight type — horizontal.



Raintight type — vertical.

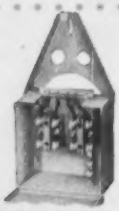
SOCKET METER MOUNTINGS — RAINTIGHT TYPE

Medium duty, single phase and polyphase.



Heavy duty.
Up to 200 Amperes.

SOCKET METER ADAPTER
For "A" Base Meter Boxes.
Indoor and Outdoor.



"A" BASE METER CONNECTION BOX
Raintight type.
Two sizes up to 2/0 wire.

"A" BASE METER MOUNTING AND TEST CABINET
Indoor. Single phase and polyphase up to 200 Amps.

POLYPHASE METER MOUNTING AND TEST CABINET
C.T. current transformer cabinets available.

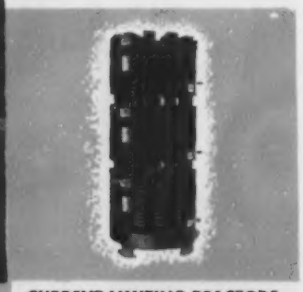
The *Crowsnest*
AERIAL LADDERS

New pedestal mount occupies least truck floor space. Fastest, easiest and safest operation. Made in three working heights — 29', 32'9 and 36'8.

COMBINATION METER SOCKET AND CIRCUIT BREAKER
Service Equipment.
One piece construction.

A. Tamper-proof Meter Seals, custom embossed.
B. Non-corrosive zinc strapping.

CABLE RACKS AND STANCHIONS
Light and heavy duty.
Porcelain insulators.



CURRENT LIMITING REACTORS
Dry type. Glass insulation.

Murray ®

ADEQUATE WIRING — THE KEY TO THE MODERN HOME — SERVES AND SAVES

For complete information, write Dept. U2.

MURRAY MANUFACTURING CORPORATION
1250 ATLANTIC AVENUE, BROOKLYN 16, N. Y.

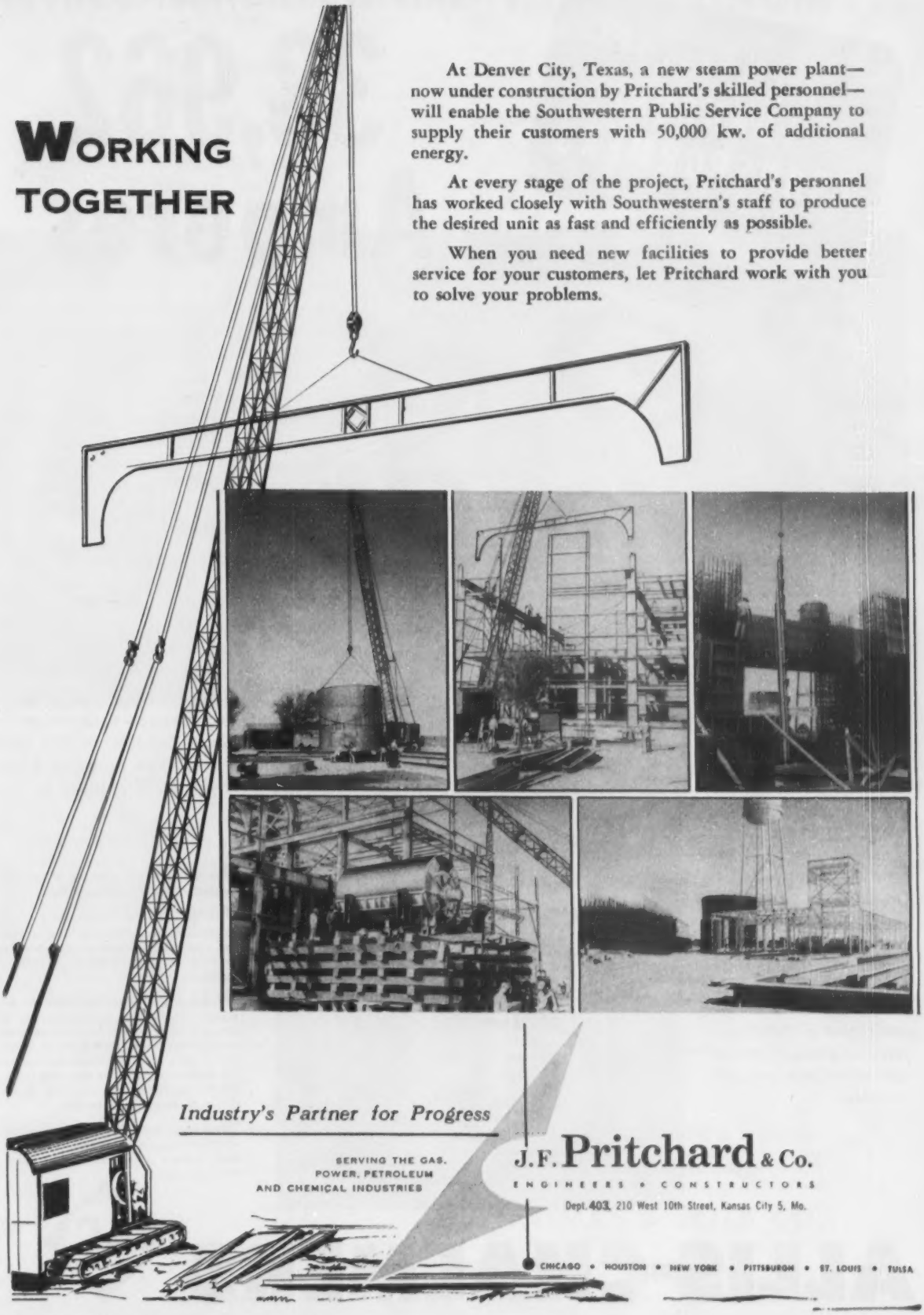
Service Entrance and Meter Equipment • Magnetic Hydraulic Circuit Breakers • Safety Switches (Types A, C & D).
Current Limiting Reactors • Crows'nest Aerial Ladders • Utility Specialties

WORKING TOGETHER

At Denver City, Texas, a new steam power plant—now under construction by Pritchard's skilled personnel—will enable the Southwestern Public Service Company to supply their customers with 50,000 kw. of additional energy.

At every stage of the project, Pritchard's personnel has worked closely with Southwestern's staff to produce the desired unit as fast and efficiently as possible.

When you need new facilities to provide better service for your customers, let Pritchard work with you to solve your problems.



Industry's Partner for Progress

SERVING THE GAS, POWER, PETROLEUM AND CHEMICAL INDUSTRIES

J.F. Pritchard & Co.

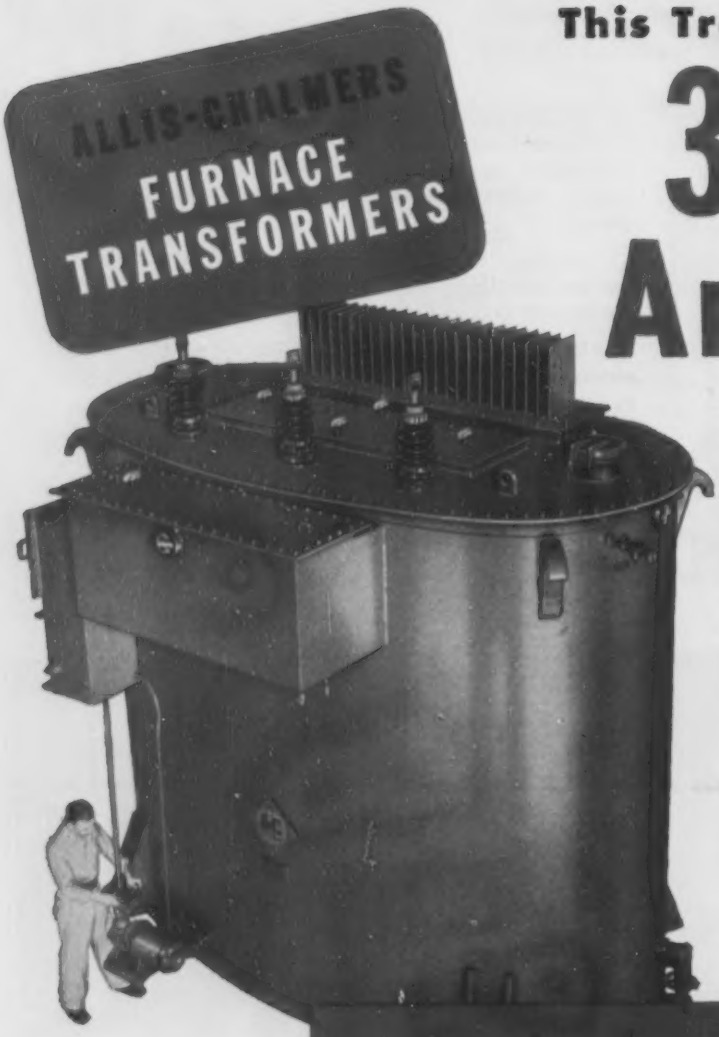
ENGINEERS • CONSTRUCTORS

Dept. 403, 210 West 10th Street, Kansas City 5, Mo.

CHICAGO • HOUSTON • NEW YORK • PITTSBURGH • ST. LOUIS • TULSA

This Transformer Delivers

33,962 Amperes



Providing high continuous current for specialized steel processing is an everyday duty for this transformer. Its well-balanced design and sturdy construction is based on past records of Allis-Chalmers transformers which show ability to withstand as much as 25 to 30 years of the repeated daily short circuits encountered in furnace operation. Allis-Chalmers has been building arc furnace transformers for over 45 years.

In addition to furnace transformers in any rating up to the largest demanded by the industry, Allis-Chalmers builds a complete line of arc furnace electrical equipment, including electrical control, circuit breakers, and auxiliary transformers.

Next time you consider a new or replacement arc furnace transformer, consult the Allis-Chalmers district office nearest you or write Allis-Chalmers, Milwaukee 1, Wis.

A-4318

One of three 20,000-kva arc furnace transformers recently built by Allis-Chalmers for a large eastern steel manufacturer. Each can deliver a continuous current of 33,962 amperes per phase. Picture at right shows core and coil assembly.

- Extremely heavy supports brace coils against severe short circuit stresses.
- Skilful insulation techniques protect windings from overvoltages due to wide tap range. Some units are designed for as much as 50% range in secondary voltages.
- Tap-changing mechanism, specially designed for furnace transformers, is in separate compartment to facilitate periodic inspection and maintenance. Wide, flat contacts provide the long life needed for numerous daily tap-changing operations. Mechanism can be either motor driven or manually operated.
- Grit blasting and three coats of baked-on alkyd resinous paint give transformer good surface protection against industrial corrosion.

ALLIS-CHALMERS

IF YOU'RE WIRING WITH ALUMINUM . . .

Utility Engineers are now installing aluminum cable in many places where only copper had been suitable. Equipment such as transformers, capacitors, cutouts, switches, and meter pans, having terminals designed for copper conductors, are now being wired to aluminum and A.C.S.R. with little or no difficulty.

How? T&B's new Aluminum Cable Adapters. They're made of heavily-tinned copper alloy; take up little more space than the cable; install in a jiffy. A lineman or electrician merely taps one onto the end of the conductor, then clamps the adapter as though it were copper conductor. "Straight" and "flag" types are available. The flag type is best for connections at right angles to cable outlets.

One of the outstanding features of these new adapters is the serrated bore. As the adapter is tapped onto the cable, the serrations bite through the aluminum oxide coating. The high-conductivity connection thus formed is maintained, despite weather and moisture, by an oxide inhibitor precoated in the bore. The clamp end is slotted and spring-like to maintain pressure during thermal expansion and contraction.

These versatile Cable Adapters are opening up many new applications for aluminum cable. Sizes for cable up to #2 Str. at present. If you're wiring with aluminum, you might possibly have a unique application. If so, let us know about it. We'll be glad to send you a free sample of the adapter and descriptive literature. Write to The Thomas & Betts Co. today.

Note how the bore serrations have scraped through the oxide coating on the cable end.

LOOK FOR THIS SIGN — AUTHORIZED DISTRIBUTOR T&B ENGINEERED

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T-415

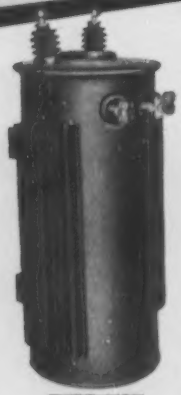
THE THOMAS & BETTS CO.

INCORPORATED

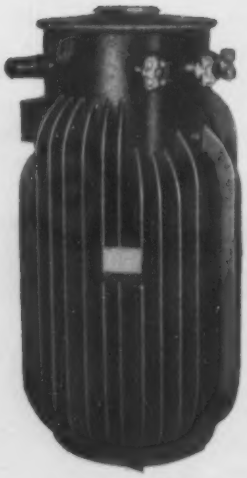
14 Butler Street • Elizabeth 1, New Jersey
Thomas & Betts Ltd., Montreal, P.Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

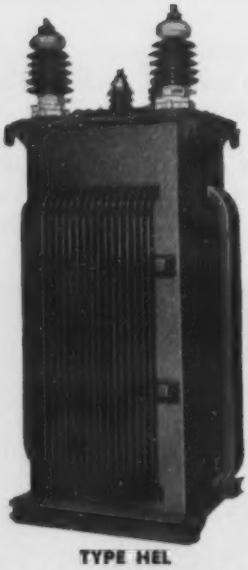
Wagner®
TRANSFORMERS
...the choice of leaders in industry



TYPE H8K
Single-phase 50 kva, 12000 to 120/420 volt transformer shown.



TYPE H8B
Single-phase 100 kva, 2400/4160Y to 120/240 volt transformer shown.



TYPE H8L
Single-phase 333 kva, 34400 to 7200 volt transformer shown.

choose Wagner

they meet all NEW EEI-NEMA Standards

The Wagner line of Distribution Transformers will meet your requirements no matter how varied they may be. The line includes *every rating and design* listed in the E. E. I.—NEMA *Fifth Report*.

When you choose WAGNER, you get all the standardized electrical and mechanical features that assure quick, easy installation and greater convenience in handling and maintenance. You get full Wagner Quality—the kind of quality that pays dividends in years of extra service. You get the benefit of improved design, better performance and longer transformer life.

You get quick delivery, too. Wagner's expansion program has provided a new plant, devoted exclusively to the manufacture of transformers, to help meet the growing demand for Wagner Transformers. And—in addition, Wagner has a nationwide organization to provide fast, convenient service, with branches in 32 principal cities.

Get in touch with your nearby Wagner branch today. Write for your copy of Bulletin TU-180. It gives complete information on Wagner Distribution Transformers.

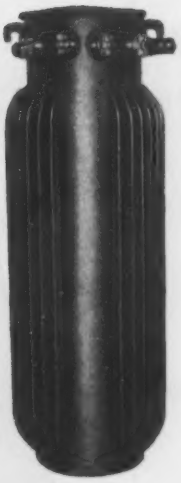
Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6456 Plymouth Avenue • St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

TYPE HPK
Three-phase 225 kva, 7200 to 240 x 480 volt transformer shown.

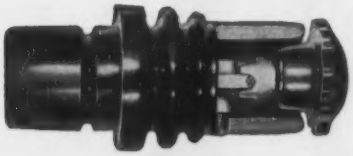


TYPE HPB (Vertical)
Three-phase 112.5 kva, 2400 to 208Y/120 volt transformer shown.

TYPE HPB
Three-phase 75 kva, 2400 to 240 x 480 volt transformer shown.

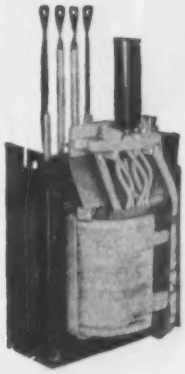
Distribution Transformers

...and offer these EXTRA features, too!



The high voltage sidewall bushings used on Wagner Distribution Transformers permit faster, easier, safer permanent connections. The conductor slips into the connector—no special tools are needed. The connector is then tightened by a few turns of the insulated finger-grip knob.

All Wagner pole-type transformers in round tanks have covers sealed to the tank with the Wagner SHUR-SEAL Clamping Ring that prevents "breathing" and gives true sealed-tank construction. Wagner Distribution Transformers are filled with inhibited oil to reduce oxidation and retard the formation of acids and sludge.



All Wagner pole-type single-phase transformers in ratings 167 kva and below are furnished with Wagner Form W core and coils that permit a liberal design in small size, lightweight transformers that give excellent electrical performance.

2% in 1945
37% in 1954
5% in 1945
50% in 1954
SECONDARY AND PRIMARY DISTRIBUTION
SERVICE DROPS

ALUMINUM CONDUCTOR IS TAKING OVER!

THESE FIGURES—from *Electrical World*, issue of May 17, 1954—are more evidence that the trend to aluminum conductor is stronger than ever before!

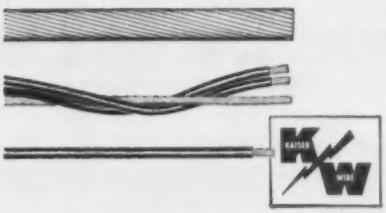
Today, 98% of all transmission lines are being built with aluminum—with services and distribution coming up fast. 37% of all secondary and primary distribution lines are now being strung with aluminum... and 50% of all service drops!

Major reason for the rapid changeover to light weight aluminum conductor is the huge savings it provides when used instead of copper ...savings that result from aluminum's far lower initial cost, faster and easier installation, lower maintenance costs.

This nationwide trend to aluminum conductor is being paced by Kaiser Aluminum's unsurpassed field, engineering and laboratory services—plus the continuing expansion of our production facilities. As a result...

THE NATION'S LARGEST SUPPLIER OF TRIPLEX AND ALUMINUM WEATHERPROOF IS

Kaiser Aluminum



For information on how to make better installations at lower cost with aluminum conductor contact any Kaiser Aluminum office listed in your telephone directory. Or get in touch with one of our many distributors. Kaiser Aluminum & Chemical Sales, Inc. *General Sales Office:* Palmolive Bldg., Chicago 11, Illinois; *Executive Office:* Kaiser Bldg., Oakland 12, California.

Long Island Lighting Company's

Noise-Proof Lines

serve half million customers

EXCLUSIVE FEATURES

Type "N" Insulators... with Conducting Glaze

1. Noise-free characteristics guaranteed.
2. *Separate* conducting glaze gives uniform surface conductivity—surface not diluted with standard brown glaze.
3. Smooth surface—no abrasion to conductor.
4. Impervious to elements—a conducting ceramic glaze.
5. Ready identification—distinctive difference in color between black "N" glaze and regular brown glaze.

An increase of 98% in new customers over a five year period—home building in boom proportions—were only a few of the tremendous growth problems faced by Long Island Lighting Company serving an area of 1230 square miles.

Television and radio interference problems also become more acute in proportion to growth. Distribution engineers, as well as the Public Relations Department must be alert for methods of quieting old lines, as well as designing quietness into new lines.

Long Island Lighting Company is one of the many utilities throughout the country using Type "N" Pintype Insulators on their lines. Type "N" construction *eliminates* radio and TV interference developing at the insulator. You, too, can be *assured* of noise-free lines and of better-satisfied customers when you specify Porcelain Products' Type "N" Insulators.

YOUR INDEPENDENT INSULATOR MANUFACTURER

60 years

Porcelain Products, Inc.

PP -INC-

PARKERSBURG, WEST VIRGINIA

Export Representative: Philips Export Corp., 100 E. 42nd Street, New York 7, N. Y.

FEWER SPLICES need be made when you run "all purpose" Durasheath. It can be run buried, overhead, in ducts . . . in one continuous run.

New trend in industrial wiring: Neoprene jacketed cable

Users find this tough, long-lasting "premium" cable actually costs little more to use . . . then cuts upkeep.

A chemical plant in Texas uses ANACONDA Durasheath* neoprene jacketed cable *as building wire* for power and lighting. A plant in St. Louis does, too. Another in Chicago.

The practice of using versatile Durasheath for power cable has caught on from coast to coast. And there's good reason.

This cable costs little more to use than the cheapest cable you can buy—and more than makes up this difference in long trouble-free service, lower maintenance costs!

Durasheath's tough jacket is made of specially compounded neoprene. It shrugs off heat, moisture, corrosive fumes. And it takes rough handling in stride. As demand for power rises, Durasheath provides added reliability.

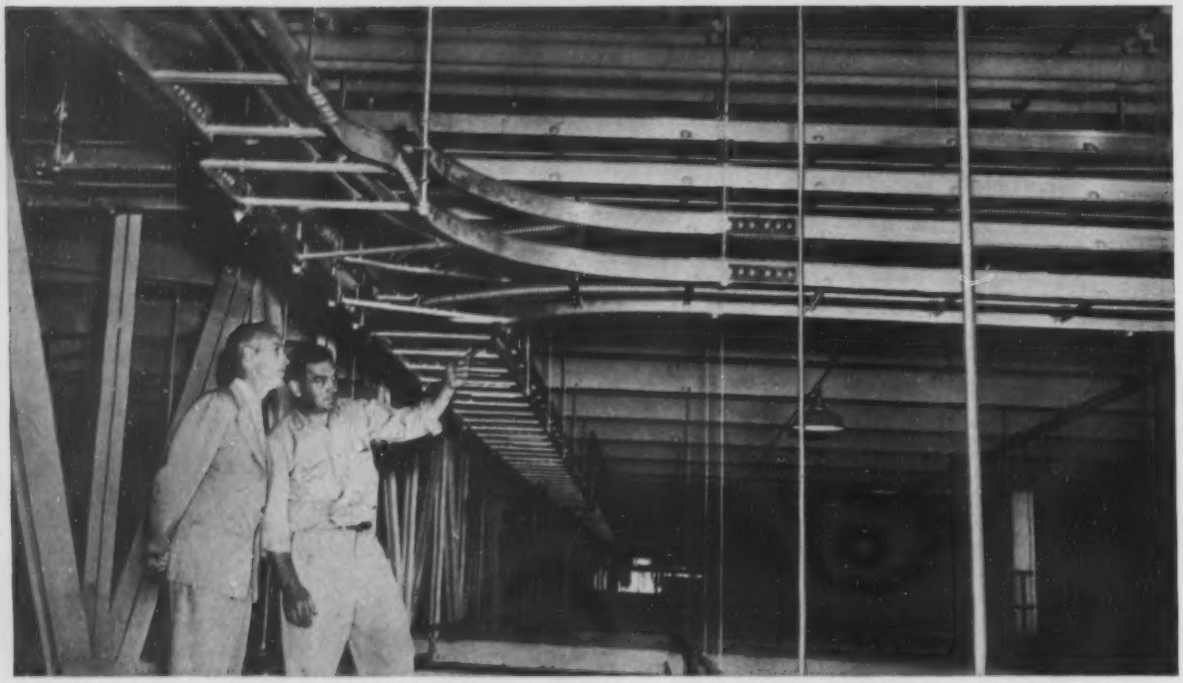
Industry engineers call Durasheath "good insurance." And it is!

Durasheath comes in all sizes, single and multiple conductor, copper and aluminum from 600 to 15,000 volts. You can run it in the ground, overhead, in damp ducts in *one continuous run* with minimum splicing. Want more information? See your Anaconda Representative or write *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.*

*Reg. U. S. Pat. Off. 54367A

Durasheath neoprene jacketed cable

ANACONDA®



Part of the General Electric V-c interlocked armor cable secondary feeder system in the Painesville, Ohio, plant of Industrial Rayon Corporation. Each cable is individually protected and individually accessible.

V-C INTERLOCKED ARMOR CABLE SYSTEM CUTS COSTS, INCREASES CIRCUIT RELIABILITY

INSTALLED COST SAVINGS

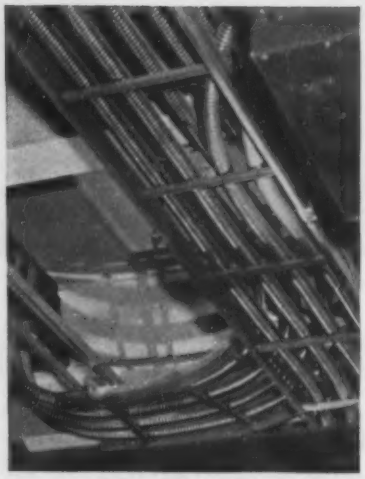
Many industrial concerns are taking advantage of the economies of a G-E V-c interlocked armor cable system. Industrial Rayon Corp., for instance, found that a G-E cable system was by far the most economical means of secondary distribution. Costs were low because the flexible interlocked armor cable could be installed fast — indoors or outdoors, around corners, over beams, and in long runs. The cable was installed on low-cost aluminum racks hung from the ceiling, and spliced with simple mechanical joints. As a result, both engineering time and installation time were cut.

INCREASED RELIABILITY

Circuit reliability is increased because each cable is individually protected, and is less apt to be affected by any fault that may occur in another circuit.

FOR NEW PLANTS OR OLD

Whether you're planning a wiring system for a new plant or modernizing an existing system, G-E varnished-cambric interlocked armor cable offers you reliable service with savings in both time and cost. Consult your G-E cable specialist, or write Section W149-827, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.



The cable bends easily. Corners and projections present no installation problem.

Progress Is Our Most Important Product

GENERAL ELECTRIC

You make the comparison...

Allis-Chalmers will ship completely free of charge to any recognized distribution system a Type JFR distribution regulator *for thirty days of thorough examination.* You can call in your engineers, purchasing people, operating and maintenance men so that they can see for themselves why your system will get more for a regulator dollar from Allis-Chalmers.

ALLIS-CHALMERS 5/8% STEP VOLTAGE REGULATORS

First Step Proves Convenient Service

The first step in examining an Allis-Chalmers distribution regulator shows why you save time and money in service. Untanking is easy because of unit construction. All that is necessary for you to do is disconnect the position indicator and remove a few cover bolts. Then hoist up on the cover-lifting eyes and the complete regulator (mechanism, control and transformer) comes out as a single unit. You can operate it outside the tank too — just energize the control from an external power source.

Design, Construction Prove Long Operating Life

Test the mechanism, for example. Its "tool designer's quality" shows why it withstands five million test operations. Look at the contacts — see their large size and arc-resisting material. No wonder utilities report they last more than a decade with no appreciable signs of wear (actual case histories).

Get complete information — and a copy of the new "regulator check list" that helps analyze all regulators. Call the A-C office nearest you or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4355

ALLIS-CHALMERS

ORIGINATORS OF 5/8% STEP REGULATION

designer's INSTRUMENT guide

RUGGEDIZED INSTRUMENTS—to military specifications, available in 2½", 3½" and 4½" sizes in D-C, movable iron A-C, rectifier type A-C and thermo instruments. All have sealed, externally operated zero correctors—shock-resisting, flat plastic windows—and connection terminals molded into internal rubber.

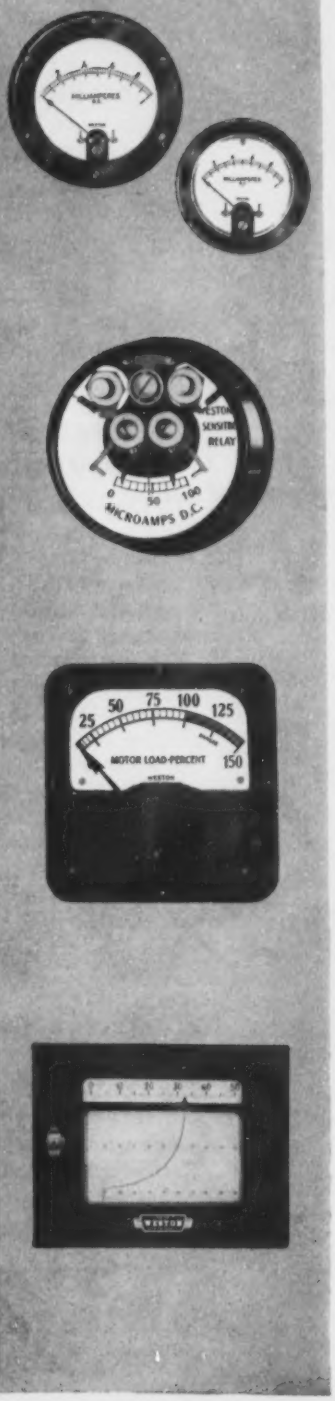
ULTRA-SENSITIVE RELAYS—extremely compact and rugged relays which operate on values as low as ½ microampere or ¼ millivolt, direct from thermocouples, resistance bulbs or other generators of minute current. Handle substantial wattage at 110 volts on non-chattering magnetic contacts. Available with single or double contacts, fixed or adjustable, manual or solenoid reset.

"MOTOR LOAD %" METERS—WESTON "per-cent load" ammeters and wattmeters make it easy for operators to secure optimum production from lathes, milling machines, automatics, grinders, etc. Prevent overloading—reduce tool breakage—assure uniform quality with fewer objects. Other scale calibrations available.

RECORDING POTENTIOMETER—ideal for built-in needs because of its extreme compactness plus ruggedness and simplicity. Ranges changed simply by inserting required range standards. Chart speeds changed by simple screwdriver adjustment. Plug-in amplifier removed in a jiffy since no soldered connections are used.

Literature on any of the above instruments sent on request.
WESTON Electrical Instrument Corporation,
614 Frelinghuysen Avenue, Newark 5, New Jersey.

8104



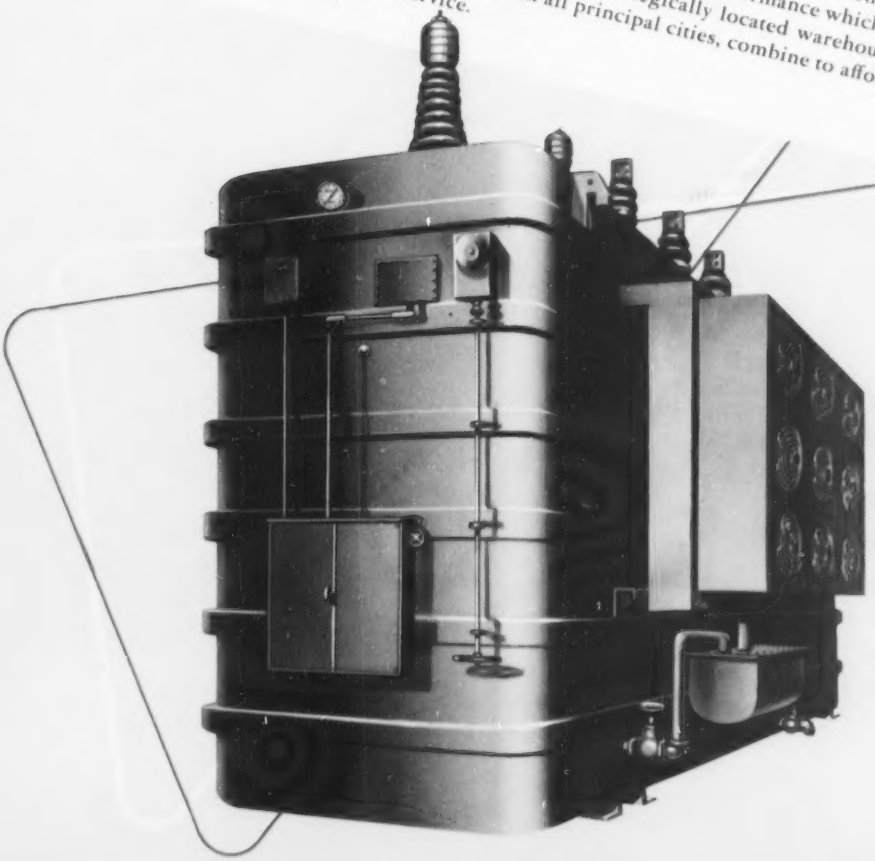
WESTON *Instruments*

MOLONEY ELECTRIC

ALL ALONG THE LINE . . .

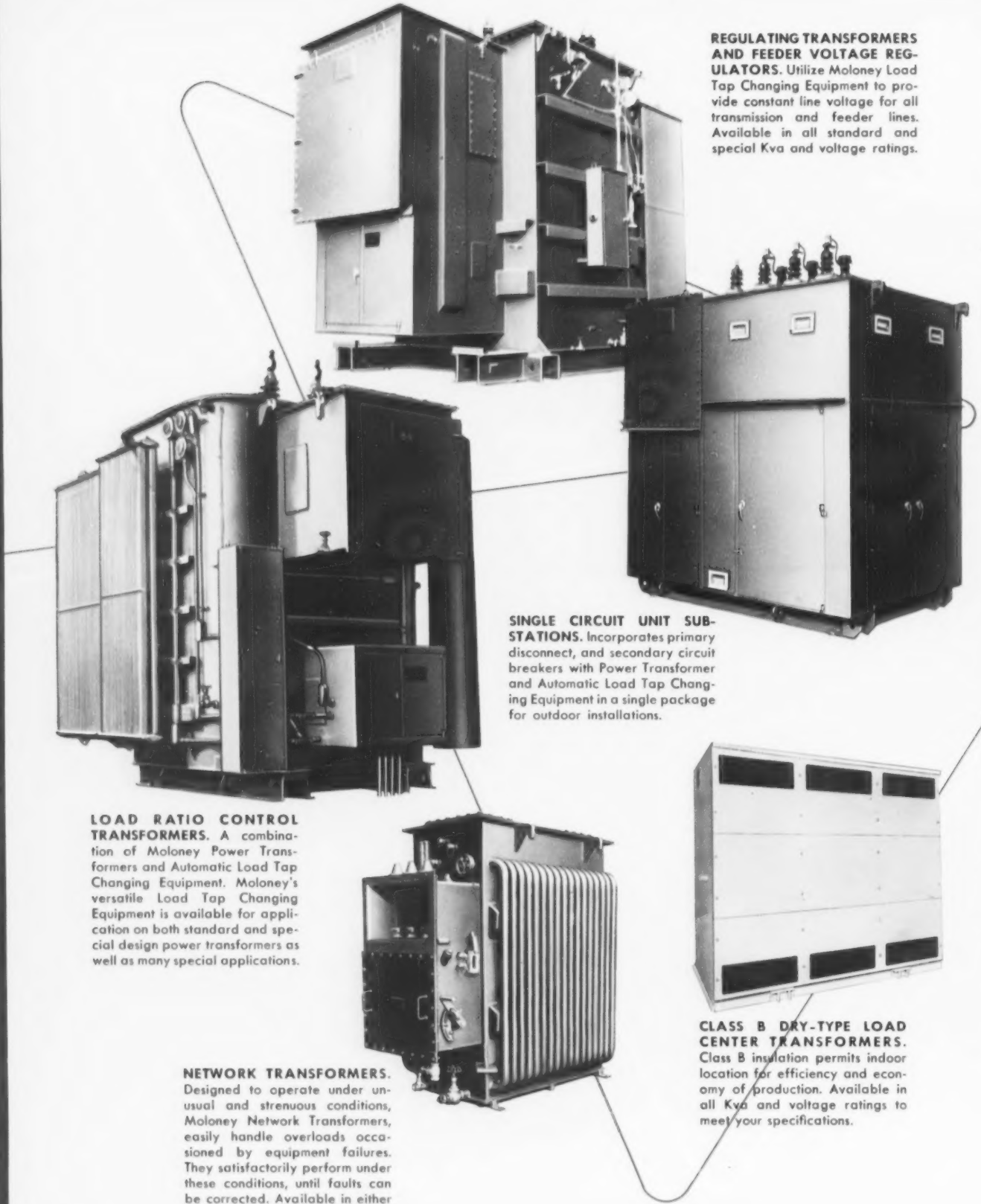
Moloney offers a complete line of quality transformers and regulating equipment from the smallest distribution transformers to the largest power transformers. Recently completed facilities enable Moloney to produce large power transformers of unlimited Kva and voltage ratings, to meet the needs of planning engineers. Climaxing over 58 years of pioneering in the design and development of quality transformers, Moloney presents this complete line of transformers for Utility, Industrial and Electronic applications, second to none in superior performance.

Moloney Design and Development Engineers produce transformers which allow you to incorporate into your system that extra performance which is so desirable. Adequate manufacturing facilities, strategically located warehouses throughout the nation plus sales offices in all principal cities, combine to afford the ultimate in delivery and service.



POWER TRANSFORMERS. Both standard design transformers and transformers engineered to your specifications. Available in Kva and voltage rating for any utility and industrial application. Moloney Engineers are available for consultation and suggestions concerning specific problems of operation or installation.

Bulletin No. G-54



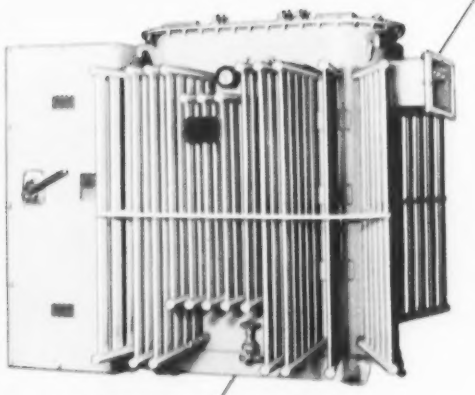
REGULATING TRANSFORMERS AND FEEDER VOLTAGE REGULATORS. Utilize Moloney Load Tap Changing Equipment to provide constant line voltage for all transmission and feeder lines. Available in all standard and special Kva and voltage ratings.

SINGLE CIRCUIT UNIT SUBSTATIONS. Incorporates primary disconnect, and secondary circuit breakers with Power Transformer and Automatic Load Tap Changing Equipment in a single package for outdoor installations.

LOAD RATIO CONTROL TRANSFORMERS. A combination of Moloney Power Transformers and Automatic Load Tap Changing Equipment. Moloney's versatile Load Tap Changing Equipment is available for application on both standard and special design power transformers as well as many special applications.

NETWORK TRANSFORMERS. Designed to operate under unusual and strenuous conditions, Moloney Network Transformers, easily handle overloads occasioned by equipment failures. They satisfactorily perform under these conditions, until faults can be corrected. Available in either EEI-NEMA standard or special ratings.

CLASS B DRY-TYPE LOAD CENTER TRANSFORMERS. Class B insulation permits indoor location for efficiency and economy of production. Available in all Kva and voltage ratings to meet your specifications.

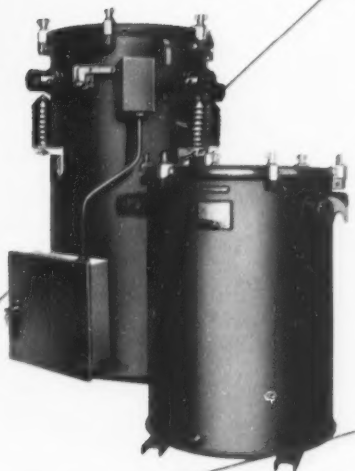


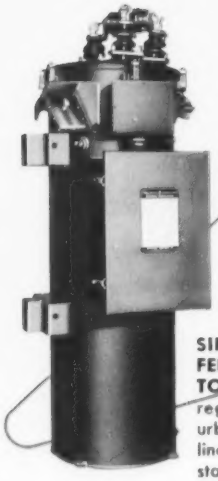
ASKAREL LOAD CENTER TRANSFORMERS. Permit indoor installation without fire hazard. Available in Kva and voltage ratings to meet your specifications.

SEALED CLASS H DRY-TYPE TRANSFORMERS. Nitrogen filled, sealed tank construction offers the ultimate in protection against fire, explosion and atmospheric contamination. Meet the most exacting insurance requirements since they neither produce toxic gases nor require expensive vaults. Installed indoors or outdoors at the job eliminating costly copper. Require no maintenance. Available in Kva and voltage ratings to meet your requirements.

SUBWAY TRANSFORMERS. Moloney quality transformers for locations where protection against submersion is required. Available in standard and special ratings.

LARGE DISTRIBUTION TRANSFORMERS. For secondary substation application. Available in all standard Kva and voltage ratings.

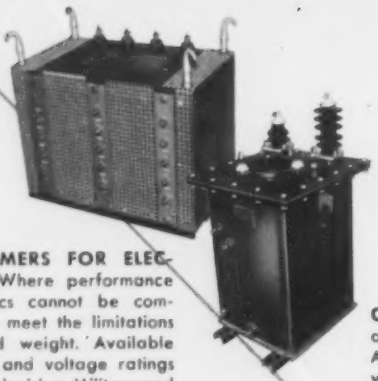




SINGLE PHASE POLE-TYPE FEEDER VOLTAGE REGULATORS. Eliminate secondary feeder regulation problems due to suburban growth and overloaded lines by providing positive, constant voltage under varying load conditions without service interruptions. Plus or minus 10% voltage regulation is provided in 32—⅝% steps. Automatic control equipment can be mounted directly to the tank or at the base of the pole.

CONSTANT CURRENT TRANSFORMERS. Maintain rated lamp current on street lighting circuits under all conditions of load. Available in standard and special ratings, in both Conventional and Packaged Unit Types.

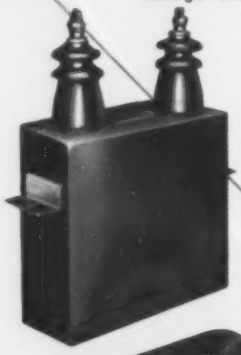
MOLONEY ELECTRIC

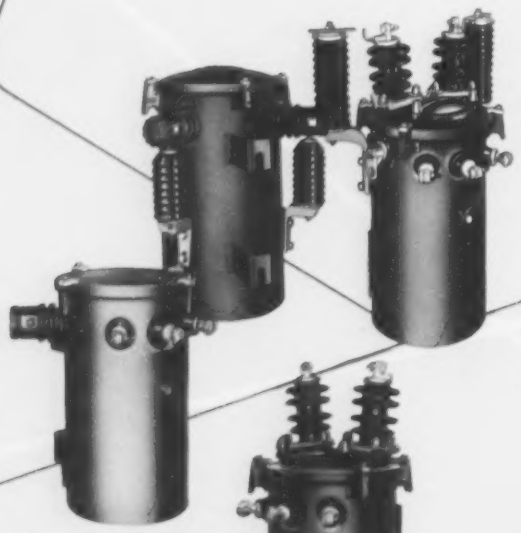


TRANSFORMERS FOR ELECTRONICS. Where performance characteristics cannot be compromised to meet the limitations of size and weight. Available in all sizes and voltage ratings for Radio, Television, Military and Special applications.

CAPACITORS. For primary voltage power factor correction. Available in standard Kva and voltage ratings.

CLASS H AND CLASS B DRY-TYPE TRANSFORMERS. Totally enclosed Class H insulated and ventilated Class B insulated transformers for small industrial power and lighting applications. Available for wall or platform mounting, thru 50 Kva.





ELECTRONIC CORES. HiperCore wound cores for smaller, lighter, low-loss electronic transformers.

HIPERCORE CONVENTIONAL AND CSP DISTRIBUTION TRANSFORMERS. Available in all standard ratings.

MOLONEY ELECTRIC

LITHO IN U. S. A.

MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Step Voltage Regulators • Regulating Transformers • Load Ratio Control Transformers Unit Substations • Network Transformers Constant Current Transformers • Capacitors • Transformers for Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

Distribution Demands Study

Distribution today remains the biggest problem in electric utility design and operation. Unlike generation, where bold swings to larger units, higher steam pressures, unit design, and radical simplification have achieved notable economy, distribution continues marching pole by pole down the highway almost as it has for many decades.

Almost—but with some new ideas. Electrical World's Trends in Distribution, completed in this issue, presents a sweeping survey. Represented are the practices of 90 utilities and 17 rural cooperatives serving 63% of the nation's meters and the visions of hundreds of competent engineers. Clearly indicated are these trends:

- Primary voltages of 12.47 and 13.2 kv are destined for use by 59% of utilities.
- Aluminum and ACSR will dominate distribution conductors.
- Switched primary capacitors will be used increasingly for voltage regulation.
- Service voltage shows no change from 120/240.
- Three-phase service expands gradually with growing acceptance of three-phase distribution transformers.
- Secondary conductors will be larger and more frequently banked.

Such are the trends disclosed by Electrical World's survey. Should they immediately be adopted in the expansion programs of all utilities? No, unless adequate study shows them to fit the requirements of each individual system.

But they should be studied—now. And they should be studied thoroughly by each and every utility. There is no doubt that the whole industry benefited from economic evaluations of the primary network idea 20 years or more ago (EW, March 14, 1931, p 500; Sept. 3, 1932, p 304; June 24, 1933, p 835). Reward to the industry then was sweeping simplification of distribution substations, both primary network and radial.

Commensurate benefits have rewarded extensive studies of transformer-secondary design economics, in which several utilities collaborated. Results of this are apparent in the widespread standardization on No. 2 secondaries and 15 to 37½-kva transformers.

Today it is time for all engineers to view distribution as a whole. The scope should extend from generating stations or major transmission substations to the customers' meters. Between these boundaries nothing should be considered exempt from change.

Growth will be a primary consideration. Where it is rapid, new facilities fast supplant existing distribution. Fear of premature obsolescence should not prevent installation of the most favorable system for long-range gains.

Slow growth, on the other hand, deters system changes. In such locations, the gain from system conversion may not offset the cost of changing existing plant. But decisions must be guided by economics.

Study is the pressing need today. For expenditures exceeding $1 billion annually are building new systems which will soon become tomorrow's distribution. Into them must go the improvements to serve tomorrow's loads more economically and reliably.

The Billboard That Sells a Better Way of Life

The billboard pictured above may appear out of place in an industry publication. However, it shouldn't for two reasons: 1. It carries a message intended for everyone. 2. It was not erected by any church or religious group but by Florida Power Corp.

The sign, located in St. Petersburg, carried its first religious message in May 1951. It was "Prayer Changes Things, Prayer Changes You." Since then the message has been changed every three months. Never has the company's name appeared on it; yet soon everybody in town knew the sponsor. And from ministers, priests, and rabbis came words of praise. Visitors and civic leaders from other sections of the country have asked for details so that they could erect similar signs in their own communities.

Such favorable reaction can be expected to any similar signs erected anywhere else in this country. For religion is a part of the American way of life.

An Interesting Situation

Co-op Power magazine reported in a recent issue on a survey of manager opinion on problems facing the co-ops. One of the questions raised was directed toward the repayment of loans before they are due. It appears that many managers feel that investing excess funds in government bonds is preferable to making payments ahead of time.

This presents an interesting situation. Co-ops can borrow money from the government at a rate of interest lower than the going rate and then can lend money earned by facilities built with the borrowed funds to the government at a profit in lieu of prepayments.

The Way the Money Goes

Strange are the workings of the human mind. This profound and entirely unoriginal observation is inspired by report of a recent colloquy between an appliance dealer and an electric utility man.

Said the appliance dealer, "If you fellows want to build residential load, why don't you offer to pay the cost of range installations in your customers' homes? Installation cost is the toughest point of resistance to range sales."

"Now look here, my friend," responded the utility man. "You're telling me that a customer won't buy a $250 electric range because it will cost him $45 to get it installed. Yet that same customer, as you know, does not even whimper when he has to cough up $75 for an antenna so he can get a picture on a television receiver he's paying $150 for."

"That's right," agreed the appliance dealer. "You see, the range is a useful thing, a necessity. The TV set is a luxury, something that's not really needed. It's the same as when you call the butcher a robber because of a 2¢ increase in the price of beefsteak and just the night before you tipped the waiter 20% on the high-priced meal you blew your wife to. We cheerfully throw away our dollars for luxuries and gripe about pennies for necessities."

A Fair Criticism Answered

"For all the building's modernity, it's that heat pump that marks it as ahead of its time." This sentence in an article on the Metropolitan Edison Co headquarters (EW, Aug. 2, p 17) brought this criticism from a reader:

"Comment that the heat pump makes the building 'ahead of its time' or that company officials believe the heat pump will become the universal heating-cooling system of tomorrow might have been used 20 or possibly even ten years ago, but not in 1954. Or hasn't your editor been reading what has been going on in heat pump development?"

Yes, all EW editors are fully aware of what has been going on in heat pump development. All are enthusiastic supporters of the pump, and that is why it was given such prominence. Buildings with heat pumps are still ahead of their time in most areas of the country. To deny this is to condemn as backward the electric companies which do not have headquarters so heated and cooled. However there are reasons for applauding Metropolitan Edison Co.

1. Heating engineers have stated repeatedly that the heat pump is most favored where cooling exceeds heating requirements. Yet in this case heating predominates.

2. This installation like others not only serves the building but also will be used to promote similar installations by commercial and industrial customers.

3. Selection of the heat pump should be viewed as further endorsement of the engineering foresight of other utilities which have pioneered its development.

THE ELECTRICAL WEEK

The Issue's News Highlights . . . Congress has finally approved a new atomic energy law which opens up the nuclear power field to electric utilities.

Navy's new YFP-10 floating power station will supply power to Jacksonville, to help compensate for failure of 35,000-kw unit at municipal plant . . . Ground-breaking ceremonies for St. Lawrence power project mark start of construction on vast hydro development.

Democratic national chairman, Stephen Mitchell, stirs up new controversy on the Dixon-Yates power proposal.

Demand for distribution transformers, particularly 25, 37½, and 50-kva, increased greatly during the recent hot spell in the central part of the country, according to several manufacturers. Run was attributed to air conditioning.

"We are studying the feasibility of the separation of our electric and gas business. No decision has been arrived at and no presumption can be made at this time as to what may be concluded," Consumers Power Chairman Justin R. Whiting told EW with regard to a newspaper report that the company was divorcing itself from the gas business.

Resolution to dissolve Union County (Ore.) PUD was voted unanimously by its board of directors and will be placed on November election ballot. This move followed results of a special election in which a $4.5-million bond issue was defeated for second time this year to purchase California-Pacific Utilities property in that area.

Ohio Power Co's bid of $466,500 for purchase of Bluffton's municipal system was accepted unanimously by Board of Public Affairs. Other bid of $501,000 was submitted by Hancock-Wood Electric Cooperative.

After rejecting all bids received in June for a Ross power plant generator, the Seattle (Wash.) Board of Public Works called for new tenders to be opened Sept. 1. Bids were rejected because of conflicts with specifications and bid instructions, and one bid was declared too high.

Connecticut L&P is latest to join growing parade of utilities sponsoring wiring financing plans. Payment can be made by home owner for period up to 36-months (with $2 minimum monthly payment) without down payment. On the labor front company and IBEW-AFL have agreed to a 5% wage increase.

Electric utility rates in N. Y. State increased $1,225,000 during 1953, according to the Public Utility Commission's annual report. Companies requested increases totaling $4,456,000, but only $1,656,000 was granted. Voluntary reductions made by several companies amounted to $431,000.

Off the Washington Wire . . . Joint Congressional Committee sources doubt that the "preference clause" written into the atomic energy bill will have any effect on disposal of power from nuclear power plant which Duquesne Light Co is helping to build near Pittsburgh. They note Duquesne will be acquiring steam—not electric power—under present agreements. Further they say power costs will not be sufficiently attractive to any potential preference customers in the area to set off any fuss.

Alabama Power Co is asking FPC for preliminary permits for two hydro projects on Black Warrior River with an initial capacity of 120,000 hp.

Interior Department has approved wholesale rates for power produced at the Eklutna project in Alaska. They call for monthly demand capacity charge of $2.25 per kw plus 6 mils per kwhr for energy used.

FPC proposes a rules change regarding issuance of hydro project licenses for existing plants. Under the proposed change, effective date of the license would be as of the date FPC first gave or gives written notice to the owner to file for a license. Previously the effective date has been Jan. 1, 1938.

Federally sponsored power corporation to develop Alaska's hydro power was suggested by Gus Norwood, executive secretary of Northwest Public Power Association, at a meeting of Alaska Rural Electric Cooperative Association in Fairbanks. NPPA is developing a similar proposal for a Columbia River power corporation for submission to next session of Congress.

Strike at Kennecott Copper Corp's plants, effecting 10,000 workers in four western states, halted operations on Aug. 16. Company offered 7¢ an hour package. International Union of Mine, Mill and Smelter Workers is asking for 8¢ an hour plus shift-differentials ranging from 6 to 12½¢ an hour and insurance benefits of $2.50 a month.

Far more rate complaints are received against REA and municipal systems than against privately owned businesses, P. M. Schuchart, director of Florida PUC public utilities department, told a recent meeting of Tampa Rotary Club members.

Mercury-vapor street lighting is largely credited with reducing traffic accidents 41% on New York City's Avenue of the Americas during first half of 1954, while accidents for city increased 2%.

Executive Changes . . . Mississippi Power & Light elected R. Baxter Wilson president to succeed Rex. I. Brown, new board chairman.

Passage of Atomic Energy Law Breaks the Federal Monopoly

New measure permitting electric utilities to construct nuclear-fueled power plants is the most significant piece of power legislation passed by the Republican 83rd Congress. AEC will assume the role of a regulatory body

Congress last week stamped its final approval on legislation to break the eight-year-old federal monopoly over civilian application of nuclear energy.

For electric utilities, the measure sent to the White House last week already ranks as the most significant power legislation enacted by the Republican 83rd Congress. History may rank it as the most important of any legislation handled by the departing lawmakers.

For the first time, electric utilities and other organizations are permitted to develop and construct electric power generating plants utilizing nuclear fuel. Furthermore, the law directs the Atomic Energy Commission to make such fuel available as a part of the licensing procedure.

The 105-page law sets up the general rules for industrial research, development, design, construction and operation of nuclear power plants (see table). It charts procedures for allocating nuclear fuel, for which title will continue to remain with the federal government.

Since it is a rewrite of all existing atomic energy statutes, the law also charts the government's role in nuclear matters and permits broader exchange of nuclear information and materials with friendly nations.

AEC—A Regulatory Body

Under the bill, AEC assumes the role of a regulatory body in the atomic energy field just as Federal Power Commission has in the hydroelectric development field. Since AEC will nominally hold title to all fuel used in the future-type power plants, its regulatory power is far-reaching.

Before even the first applications for research licenses can be processed, AEC must transfer the general rules of the law into specific regulations for granting licenses. It must set up minimum health and safety standards for different types of facilities and create a body of procedure and an organization for processing license applications.

Observers think it will take a minimum of four months before the fine-print regulations will be in shape for processing the first application for a research license. It may be a year or more before AEC will be prepared to handle applications for the construction of a commercial nuclear power plant.

Public Power Tinge

In any event, it is not believed that the new atomic energy law carries greatly delay progress in the new field since no reactor-type has yet been certified to be of commercial value. That is a prerequisite for obtaining a commercial-type license for a plant.

As it finally came from Congress, the new atomic energy law carries a discernable public power brand. Many of the pro-public-power amendments written in by the Senate remained in the final version of the bill.

Final Senate tally on the measure was a convincing 59 to 17 in favor. The 17 opponents were all Democrats with the single exception of Independent Sen Wayne Morse of Oregon.

Prior to final passage, the public power bloc in the Senate had forced the bill back to a second conference with the House to insist that the Senate amendments be accepted. This time the bloc had lined up almost solid Democratic support which, along with four Republicans and Independent Morse, gave it a 48-to-41 vote to reject the original conference report on the bill. In the three hours of strictly limited debate on the original conference report, the bloc was able to hold on to the gains made during the 13-day filibuster earlier in the month.

On the second go-round, the public power Senators won both their demands:

- That public bodies and cooperatives be given preference both in applying for atomic power plant licenses and in purchasing AEC-generated power from nuclear sources.
- That basic patents in the nuclear power field be subject to compulsory licensing during the first five years following enactment of the new measure.

Passage of the measure came just two years after the Joint Congressional Committee first began its study looking toward relaxation of the federal monopoly over atomic energy. Another series of preliminary hearings were conducted in June and July of last year on this subject, but it was not until May of this year that hearings got underway on specific legislation to foster industrial development of atomic energy.

The original and subsequent versions of the legislation was introduced by Republican Rep Sterling Cole in the House and Republican Sen Bourke B. Hickenlooper in the Senate.

Change in 'Center of Gravity'

In commenting on passage of the new law, a spokesman for Atomic Industrial Forum said: "A long period of government monopoly is now at an end. We will soon begin to see the center of gravity in atomic energy moving towards industry and away from government. Industry now joins government as a full partner in keeping the U. S. at the forefront of atomic energy development."

Doing Business Under the New Atomic Energy Law

	Present Law	New Law
Private ownership or use of nuclear material	Prohibited	Private industry would be permitted to produce and use nuclear material under AEC license, although title would remain with the federal government.
Private Research involving use of nuclear materials	May be done under AEC contract or sponsorship	Private firms are encouraged to conduct research in nuclear field under AEC license using fissionable material furnished by AEC either free or for nominal charge.
Development of atomic power plants and search reactors	May be done under AEC contract	AEC would be empowered to license such development and furnish nuclear fuel for use.
Non-AEC construction and operation of atomic power plants	Prohibited	AEC would be empowered to issue construction permits and licenses for such projects and furnish the necessary fuel.
Preference in issuing licenses for construction and operation of commercial nuclear power plants	No provision	AEC must give preferred consideration to application for facilities in high-cost power areas and to public and cooperative bodies where there are conflicting applications with limited opportunity for such license.
Patents for discoveries and inventions relative to the use and production of nuclear materials	All such patents become the property of the federal government.	All non-weapon inventions in the nuclear field may be patented under normal procedure, but basic patents in the atomic power field filed before Sept. 1, 1959 will be subject to compulsory licensing under royalty fees determined by AEC.
Sharing restricted nuclear information with non-AEC personnel	All personnel requiring access restricted data must have the same security clearance.	Information will be classed according to its sensitivity and security clearances for access to different classification will be fixed accordingly.
Government research in nuclear field on behalf of non-federal group	No provision	AEC may conduct research for outsiders if personnel and facilities are available. Commission may charge for this service or provide it free.
Preference in sale of power generated incident to AEC's production, research, or developmental activities.	All potential purchasers have equal standing	Public bodies and rural electric cooperatives given priority in the purchase of AEC-generated power from nuclear sources.
AEC division charged with fostering civilian application of nuclear energy	No provision	Such a division would be created with duties parallel to the present division on military application of atomic energy.
Use of radioisotopes by private industry	Permitted under AEC license	Encourages freer distribution of isotopes for industrial purposes with a minimum of regulation.
Export of power or experimental reactors	Prohibited	Permitted under AEC license when agreement of cooperation is in effect with the recipient nation.

Gets Navy Power

Jacksonville, Fla., granted use of U. S. floating station to replace disabled generator

The City of Jacksonville, Fla., last week was granted permission from the Secretary of the Navy to use that department's new floating power plant YFP-10 to replace the municipal utility's biggest turbo generator unit which failed earlier this month.

Loss of the 35,000-kw unit at the city's Talleyrand generating station cut the generating capacity of the system by about one-fifth—from 182,000 kw to 147,000 kw.

To Dock at Station . . . The 34,500-kw Navy unit will be tied-into the same feeder position as the Talleyrand station's disabled No. 7 generator within the next two weeks. It will be moored at municipal docks at the station, which is located on the St. Johns Rivers. The floating plant, never before in service, houses three 11,500-kw steam generating units.

In commenting on the failure of the unit, a 15-year old piece of equipment, Robert B. Cowan, engineer-manager of the municipal, said the breakdown was due to the failure of the generator field.

The engineer-manager said, "The field winding was subjected to a complete electrical test around midnight Tuesday (Aug. 10) after the unit was shut down and test disclosed short circuited coils, inclusive of at least one ground to the rotor core."

20 Weeks for Repairs . . . Repair work on the unit is expected to take about 20 weeks. General Electric Co will rewind the field at Schenectady.

Although no brownouts have been ordered, Utilities Commissioner J. Dillon Kennedy has appealed to the public to curtail use of power until the supply can be restored to normal.

To meet future power needs of consumers, Jacksonville is currently working on two new additions. Completion of a 44,000-kw unit for the Southside Station is planned in the latter part of 1954. The 44,000-kw turbogenerator unit now being constructed for the Talleyrand plant may be completed by March, 1955.

AT MASSENA, N. Y., Gov Dewey starts by setting off . . .

. . . initial explosives which send up a large geyser of water off the tip of

Americans Used Dynamite to Break Ground for St. Lawrence Power Project;

NO MATTER HOW THEY DIG IT, IT'S MORE POWER

Dynamite charges and ordinary shovels were used on Aug. 10 to get the St. Lawrence power project off to a ceremonius start. Dual celebrations were held on American and Canadian soil to inaugurate the 1.9 million-kw hydrolectric development whose power will be shared equally by the two nations.

Among the dignitaries officiating at the ceremonies were New York's Gov Thomas E. Dewey and Canada's Prime Minister Louis St. Laurent, and New York State Power Authority Chairman Robert Moses and his Canadian opposite number, Robert H. Saunders, chairman of Hydro-Electric Commission of Ontario. The $630-million project is being constructed under the direction of the New York Power Authority and Ontario Hydro.

Officials Participate . . . The groundbreaking festivities began on the American side of the border near Massena, N. Y. Governor Dewey pressed a button setting off dynamite blasts off Barnhart Island where one of the dams will be built.

Then the groundbreaking party traveled to a spot near Cornwall, Ont. where Prime Minister St. Laurent removed the first spadeful of earth at the Canadian powerhouse site.

Discusses Policy . . . In a speech touching on power policy, Governor Dewey hailed New York's participation in the St. Lawrence project as "a profound contribution to our political thinking."

He continued: "Before the New York Plan there were just two warring schools of thought on this subject. One group wanted not only to develop this project with public funds, but also to use the power for the advantage of a tiny 2 or 3% of the people served by publicly owned power plants, with the balance of the power to be used as a club to beat free citizens into adopting similar programs."

On the other side, said Dewey, were those who wanted to take the people's assets for private use. And the achievement of the New York Plan, he declared, is that it bridges the gap between the two schools of thought. "It permits public development of the people's water power to be joined with effective private distribution for the benefit of all of the people of the state, without the woolly-eyed schemes for duplication of existing transmission and plant in places where they are both unnecessary, costly and against the public interest," Dewey said.

"In short," contended the New York governor, "we are today seeing a rational solution to a problem which has plagued honest men for many decades. For nearly half a century the people of this state were caught between the irresistible force and the immovable object and the people were the victims. Today the interest of the people and of our free system is being served in a new and creative fashion which may well serve as a model for the solution of many similar difficulties in the life of the nation."

The vast St. Lawrence hydro development will consist of two major dams, the powerhouse structure (which is also a dam), power generating and transforming facilities, extensive channel works and dikes and wing dams.

Long Sault Island where a dam will be constructed

AT CORNWALL, ONT., Canadian Prime Minister St. Laurente is joined by Governor Dewey and Ontario Hydro Chairman Saunders in turning over sod for power plant

Canadians Wielded Spades, but . . .

FOR BOTH SIDES

Two Dams, One Powerhouse . . . Irodams will be known as Iroquois Dam, a short distance downstream from Ogdensburg, New York, and the Long Sault Dam, near the head of Barnhart Island. All power will be generated at the Barnhart Island power plant with one end in the United States and the other end in Canada.

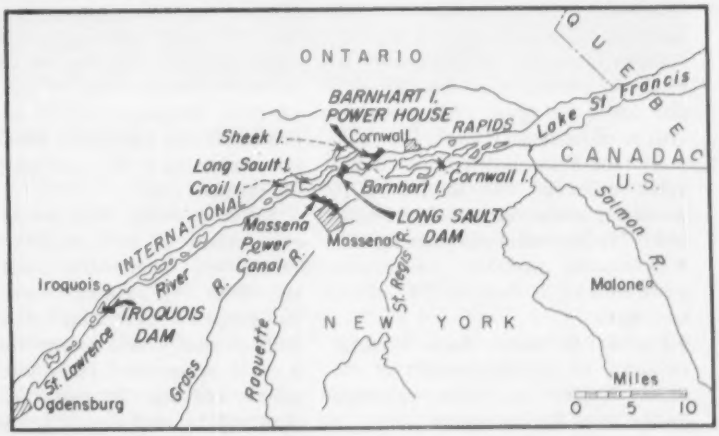
Construction of the two cofferdams is expected to begin immediately.

First generation of power is scheduled to begin in 1958 and the project is expected to be completed a year later.

Cost of the project will be shared equally by the two power agencies except machinery and equipment for the respective powerhouses.

The St. Lawrence Seaway project and the power project are closely related but financially and otherwise separable. The two projects will be constructed by different contracting groups. Joint use of the river by the two projects, however, requires that they be completely coordinated in planning and operation.

MAP shows location of dams and powerhouse for St. Lawrence hydroelectric development



REA Loan Record

Agency steps up lending activities, cuts application backlog during fiscal year

During its first full fiscal year under Republican chieftains, the federal rural electrification program has stepped up its loan volume over the previous fiscal year and reduced the backlog of loan applications to the lowest point since 1947.

Preliminary figures for the fiscal year ended June 30 recently released by the Rural Electrification Administration show that 325 loans were approved for a total of $165 million during the year as compared with 345 loans totalling $167 million for the previous year. (For story on REA operations through fiscal 1952, see Washington Comment p 102).

However, funds actually advanced on these and previous approvals were $182 million as compared with $208 million for the previous fiscal year.

Loan Application Backlog Cut . . . Backlog of loan applications was trimmed from 193 as of June 30 last year to 157 as of June 30 this year. Amount represented was $193 million for the 1953 fiscal year and $118 million for the 1954 fiscal year.

The report also indicates a sizable step-up in the use of electricity by individual consumers. Average consumption per rural customer in 1941 was 919 kwhr annually. This rose to 1,602 kwhr in 1946, 2,760 kwhr in 1952 and to 3,036 kwhr for 1953.

'Individual' Rates Decline . . . During this same period rates paid by individual rural consumers gradually decreased. They were 4.83¢ per kwhr in 1941, 3.63¢ per kwhr in 1946, 2.81¢ in 1952 and 2.67¢ in 1953.

Other highlights of the report:

- Almost one-fourth of the electrification loans for fiscal 1954 went for system improvements.
- Average REA electric borrower has 1,290 miles of line serving 4,010 customers, compared with 1,191 miles and 3,710 customers two years ago.
- Delinquent payments on electric loans amount to about 0.09% of the total due.
- Electric borrowers have obtained advances for $2,444,000,000 of the $2,886,000,000 in loans approved since start of REA program.

Utility Employee Wins Photo Contest

Robert J. Chinn (left) photographer for Public Service Co of Colorado, is shown with his picture and the $5,000 check it won as first prize in a national contest conducted by Sylvania Electric Products, Inc. He was presented the check by William Shewmaker, owner of the Camera Exchange of Colorado, where Chinn bought the flash bulb used in making the prize-winning picture. Chinn, using a 4x5 Busch Pressman camera, shot a picture of two children having a sand fight on the beach near Santa Barbara, Calif. He took the picture on a vacation trip. Chinn is employed in the publicity department.

Nelsen Reaffirms Policy on Granting G&T Loans

Rural Electrification Administration under Republican Ancher Nelsen has one overriding criteria for processing generating and transmission loan applications: They must be designed to bring the farmer-consumer power cheaper and more dependably than he could get it from other possible sources.

This policy was reaffirmed in a statement by Nelsen. "I am convinced," he said, "that this authority (to grant G&T loans) must be preserved and that the best way of preserving it is to use it wisely and well." He noted such loans totalled $42 million in the first year of his administration compared to $34 million during the previous year.

Before granting such loans, however, Nelsen said REA must be shown conclusively "That energy is not available from any existing source; that the proposed generating plant can produce energy at a lower cost than it could be obtained from any other source; and that the output of such plant will be used mainly for supplying energy for use in rural areas."

He said there have been cases of members of distribution co-ops threatening to disconnect because of high retail rates resulting from REA-financed generation and transmission facilities.

"What has happened in too many of these cases," Nelsen continued, "is that the general reduction in wholesale rates charged by power companies has left some of the REA-financed groups 'stuck' at higher price levels. With full honor to the ontrepid rural people who pioneered in the generating field, we must all be concerned about the ability and willingness of farmer-users of power to pay rates necessary to operate their systems and pay off government loan."

REA listed these reasons for wanting to retain G&T loan authority: (1) It is one of the means of meeting needs of rural people for adequate, dependable power supply at reasonable rate, (2) it gives co-ops a bargaining position in negotiations as equals with electric companies; and (3) it enables co-ops to obtain lower costs resulting from interconnections, stand-by arrangements with other electric power organizations.

Rivals Discuss Priest Rapids

Washington State Power Commission and Grant County PUD consider applying jointly for FPC license to build NW project

Two contenders for authority to build Priest Rapids Dam on the Columbia River are considering joining in an application to Federal Power Commission and deciding later which agency would build the project.

The Washington State Power Commission, one applicant, and the Grant County PUD, the other, moved toward a joint application in a meeting Aug. 10 at Ephrata, at the suggestion of Walter S. Gordon, chairman of the commission. The PUD further proposed that joint application for a preliminary permit be extended to include all four possible licensees. The four, envisioned by Congress, are the power commission, the Grant PUD, a joint operating agency of utilities, or a combination of public utility districts. So far the state power commission has not agreed to including the four.

"Grant County PUD doesn't necessarily have to build Priest Rapids," declared PUD Manager Glenn A. Smothers. "We want to see it built by the organization best equipped to build and continue operation if the federal government steps out," he added.

Questions Commission's Authority . . . The Grant PUD, Smothers explains, has invested in preliminary studies of the site, while the power commission "hasn't even adjudicated its own law." There has been no state supreme court test case to determine legal powers of the state commission, Smothers said, and, "this should be done before the commission attempts to issue revenue bonds."

The meeting between the applicants began with a proposal by each, both of which were rejected.

PUD Rejects Proposal . . . The power commission suggested that it build Priest Rapids, and the PUD install "one or two generators" for its exclusive use. This was turned down because "that generator might sometime be spinning when the PUD didn't need the power, and the power—reserved—wouldn't flow into the power pool."

The PUD urged the state commission to step aside, since it has no guaranteed legal authority to issue bonds to build the project. Then Gordon proposed a joint application, with the possible licensees determining later which shall build the project.

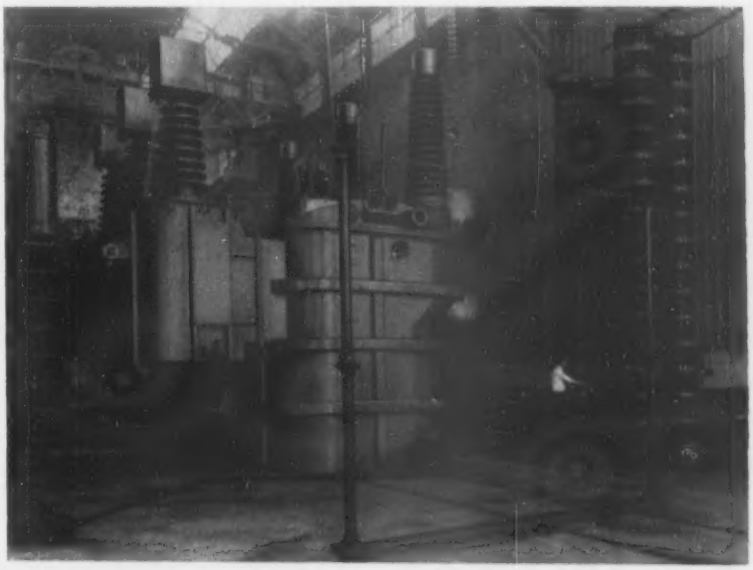
The Grant PUD was scheduled to sponsor a public meeting Aug. 20 at Ephrata to discuss who can best build and operate the project. On hand would be engineers, panels representing contending applicants, representatives of bonding firms and bond approving council representatives from New York, Chicago, and Seattle.

On Sept. 1, Smothers plans to visit Washington, D. C. to talk about a one- or two-dam project with the Army Corps of Engineers, Atomic Energy Commission and FPC. The PUD favors a two-dam project.

FPC Extends Deadline for Hells Canyon Briefs

Federal Power Commission hearing examiner William J. Costello has extended from Sept. 11 to Oct. 11 the deadline for filing the so-called "first brief" in the Hells Canyon controversy. Both the National Hells Canyon Association, which advocates a high federal dam on the Hells Canyon stretch of the Snake River, and the FPC staff attorneys had asked for an extension. Evelyn Cooper, attorney for NHCA has requested a 60-day extension and John C. Mason, FPC staff attorney had asked for 30 days. Idaho Power Co, which is seeking an FPC permit for a 3-dam plan had asked that both requests be denied.

Costello had the due date for "reply briefs" pushed up 30 days to Dec. 13. If Idaho Power wants to file a brief in answer to these reply briefs, it will have until Jan. 10, 1955. Costello will reveal his decision next spring.



Super Grid Transformer Meets Tests

This 120-MVA 132/275-kv three-phase auto-transformer with on-load tap changers has been subjected to impulse tests in Metropolitan-Vickers works at Trafford Park, Manchester, England. The transformer will be used in British Electricity Authority's 275-kv super grid.

The impulse voltage withstand levels based on a 1 x 50 micro-second wave, are 1,050 kv for the 275-kv winding and 550-kv for the 132-kv winding. The tappings and tap changers are at the 132-kv point and so are subject to the full impulse voltage.

The transformer successfully withstood the tests, which were the first to be carried out on a super grid auto-transformer complete with on-load tap changers.

Light's Jubilee Is Theme of Prize-Float

Iowa Public Service Co used Light's Diamond Jubilee as the theme for its float in Sioux City's Centennial Parade last month and walked off with No. 1 honors in the industrial division.

An IPS employee portrayed Thomas Edison and toyed with a replica of the first incandescent lamp to recreate the atmosphere of the memorable invention at Menlo Park. To depict the progress of electricity since that time, the float included General Electric Co's 75,000-w bulb. Rounding out the central idea, Reddy Kilowatt, at rear of float, opened the door to today's modern living.

Detroit Again Rejects Bids for Mistersky Station Unit

Detroit's Public Lighting Commission has rejected all bids on the 50,000-kw turbogenerator for the Mistersky Station. It was the second time in about a year that bids on the power plant were turned down.

Brown Boveri Corp of New York, a subsidiary of a Swiss firm, submitted a low bid of $1,296,000 last summer, but had it rejected in a stormy battle which centered on the firm's inexperience in building a generator of this type. All other bids were rejected at that time, too (EW, Oct. 12, 1953, p 44). Later, specifications were changed in such a way as to virtually eliminate Brown Boveri from the bidding (EW, June 14, p 97).

This time bids were rejected because none met specifications.

Westinghouse Electric Corp was low bidder at $1,895,700. Westinghouse's bid was rejected because an outline drawing of the unit which the company proposed to build showed the unit to be 4 ft longer than could be accommodated by the proposed building which would house it. To enlarge the building would have added about $50,000 to the construction cost of the station, the commission stated.

General Electric Co submitted a bid of $1,920,000 and Allis-Chalmers Manufacturing Co submitted the highest bid of $1,950,667.

The commission has ordered new bids. All three of the above companies are expected to resubmit bids. Opening date for the new bids will be Aug. 25.

AEC Building Approved

Construction of Atomic Energy Commission's $9.6-million building in the Washington, D. C., area under the new lease-purchase law has been approved by the House's Public Works Committee. AEC's new headquarters will be built about 20 to 30 miles outside the district.

Inter-Industry Group Sets Rural Loadbuilding Meets

Dates and sites of a series of five regional meetings for organizing its state-level rural electric loadbuilding program were announced by the Inter-Industry Farm Electric Utilization Council at a meeting in Chicago Aug. 13 (EW, Aug. 16 p 5).

Program is enlisting efforts of electric companies, rural cooperatives, appliance and equipment manufacturers to help step up the use of electricity in rural areas. Representatives of each of these groups will be invited to attend one of the meetings. They are scheduled as follows:

Sept. 21, St. Paul, Minn., at Hotel Lowry—North-Central area (North Dakota, South Dakota, Minnesota, Wisconsin, Iowa, and Illinois);

Sept. 28, Denver, Colo., at Shirley-Savoy Hotel—Western area (Kansas, Nebraska, Montana, Wyoming, Colorado, Idaho, Utah, Nevada, Washington, Oregon, and California);

Oct. 12, Columbus, Ohio, at Deshler-Hilton Hotel—Northeast area (Ohio, Michigan, Indiana, North Carolina, Virginia, West Virginia, Maryland, Pennsylvania, New York, Delaware, New Jersey, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island);

Oct. 15, Ft. Worth, Tex., at Texas Hotel—Southwest area (Texas, New Mexico, Arizona, Oklahoma, Missouri, Arkansas, and Louisiana);

Oct. 20, Nashville, Tenn., at Andrew Jackson Hotel—Southeast area (Tennessee, Kentucky, Mississippi, Alabama, Georgia, South Carolina, and Florida).

Power Exchange Contract with USBR Is Approved

Fort Collins, Colo., city council has approved a 20-year contract with the Bureau of Reclamation for mutual exchange of firm and emergency power between the bureau's Colorado-Wyoming power system and the city's plant.

The exchange will go into effect Sept. 1 upon completion of an $85,000 transmission line from the Fort Collins 10,000-kw steam plant to the bureau's Poudre substation.

City officials said a 5% discount to the municipal government on bureau power is expected to amortize the cost of the line in 17 years.

Gains Made on Columbia Pact

Delegates agree on voting, membership, scope of interstate commission. Power, water apportionment at issue

Columbia Interstate Compact Commission planners reaffirmed intention to establish an organization with advisory status only in a vote at a meeting in Portland, Ore., Aug. 9-10. At the session substantial progress was achieved in organizational matters, particularly the voting representation of the seven state members.

But while consideration of redrafted articles first reviewed in Spokane (EW, June 21, p 22) found delegations in accord on most points of the proposed contract, there remained a division over allocation of power and a complete impasse on the apportionment of water between upstream and downstream states where consumptive and nonconsumptive rights are in conflict. As delegates from Washington, Oregon, Idaho, Montana, Wyoming, and Nevada (Utah was absent) neared the end of the two-day session, they agreed to postpone further debate on the water apportionment issue until a Sept. 11 meeting in Missoula, Mont.

Construction Role Rejected . . . Proposal to give the commission power to issue revenue bonds and build hydroelectric projects if public or private agencies fail to act on the commission's recommendations to do so was rejected. The plan was offered as an amendment to an article defining the commission's general powers. But the commission reaffirmed position taken at the Spokane meeting that commission powers be limited to collection of data for uses of water and other resources in the basin, recommendations for basin development, and review of plans for flood control navigation, power, and irrigation.

Voting and Representation . . . Permanent voting and membership of the seven states and the United States will give the four major basin states of Washington, Oregon, Idaho, and Montana two members each and Wyoming, Utah, and Nevada one each. The United States Commissioner will be chairman without a vote. Member commissioners will vote separately with eight constituting a quorum providing at least one commissioner from Washington, Oregon, Idaho, and Montana is present.

Upstream-vs-downstream disputes are reflected in the article for allocation of power. In summary of the draft, this reads:

"Provides for commission review of all upstream hydroelectric developments and determination of the amount of power equitable for reservation at-site, taking into consideration downstream benefits. In a project located partly in an upstream state and partly in a downstream state, reservation is to be the same in quantity as stated in the preceding sentence but made to the 'upstream area' within the states concerned. Power may be made available elsewhere until needed by the state where the project is located and may only be withdrawn on reasonable notice."

Two alternate clauses were before the Portland session. One allowed the commission to find reservation impracticable on either a federally financed or federally licensed project. The other, finally adopted as policy, allows the commission to find reservation impracticable on a federally licensed project but requires reservation on a federally financed project. Oregon's delegation argued for the first alternate and stood alone in the adoption of the second. Oregon explained the adopted policy requires the commissions to make a reservation even though it is impracticable.

Water Apportionment Is Issue . . . Water apportionment proved to be the anticipated barrier to speedy accord among the delegations and promises to continue to plague the success of efforts to have the compact accepted by the various state legislatures.

The principal obstacle to agreement is the demand of Idaho, Montana, Wyoming and Nevada—and presumably Utah on matter of principle—that they be assured consumptive rights to all stream flow within their boundaries in perpetuity as a prior claim over those of Washington and Oregon for water for nonconsumptive use, chiefly for power generation and industrial uses. The downstream states recognized the principle of their subordinate claims, but want to establish a limitation and a re-examination of the policy, say 25 years hence. Washington has proposed the year 1980 for review. Oregon's representative said his state legislature never would accede to the upstream states' claims in perpetuity.

Mitchell Attacks Dixon-Yates Plan

In a speech last week at Chicago, Stephen A. Mitchell, chairman of the Democratic National Committee, implied that Dixon-Yates proposal was example of Republican corruption.

At an American Bar Association luncheon, the Democratic national chairman, intimated there might be a connection between the fact that President Eisenhower and Bobby Jones, noted golfer and Southern Co director, and the fact that the President had directed the Atomic Energy Commission to work out contract with Southern Co and Middle South Utilities for power in the TVA area.

Mitchell said the contract was awarded the Southern Co, whose board chairman is E. A. Yates, and Middle South, whose president is Edgar Dixon, although a competing syndicate offered to provide the power for $90 million less and TVA for $140 million less.

"In my view, giving away the people's property is corruption even if it's done brazenly in broad daylight," he declared.

In Atlanta, Bobby Jones branded Mitchell's remarks "utterly ridiculous and without foundation." He said emphatically he had never had any communication with the President or any other member of the government on the Dixon-Yates proposal and doubted if the President knew he was a Southern Co director.

Jones, as of February of this year, owned 564 shares of Southern Co stock out of a total of more than 18 million shares. He and his wife also have a 45% interest in a bottling firm which holds 500 shares of the utility company stock.

On the day following the Mitchell charges, the President defended Jones and offered to make public records on the disputed contract.

PUBLIC RELATIONS & ADVERTISING

'You Are There' to Open 3rd Season on Aug. 29

"You Are There," the TV program which brings to life great events in world history, returns for its third season on Sunday, Aug. 29. The opening show will be "The Treason of Aaron Burr."

Though the time will vary throughout the country, the first presentation each week will be at 6:30 PM (EDT) every Sunday over the CBS-TV network. Sponsoring the show alternately will be the Electric Companies Advertising Program and the Prudential Insurance Co of America.

The program has been well-received and endorsed by public and other school officials. The practice of supplying teaching aids for each ECAP-sponsored show will be continued. The first of these will be available for the Sept. 12 telecast, "The Oklahoma Land Run." The aids are moderately priced and can be secured from Western Newspaper Union, 310 East 45th Street, New York 17, N. Y.

Shows scheduled through September are as follows:

Aug. 29—"The Treason of Aaron Burr."

Sept. 5—"The Emergence of Jazz."

Sept. 12—"The Oklahoma Land Run."

Sept. 19—"William Pitt's Last Speech to Parliament."

Sept. 26—"The Return of Ulysses."

Jubilee Film Now Being Distributed

"The Eager Minds," Light's Diamond Jubilee Committee's 16-mm color film, is now being distributed to electric companies participating in the Jubilee.

Produced by RKO, the film has a complete musical score, runs for 27 minutes. Story revolves around a small boy who grows up to play a prominent part in the development of electrical living. After a look at what has been accomplished since Edison's invention of the incandescent lamp, it centers heavily on electricity's future promise. New developments like the solar battery are spotlighted.

Picture has been cleared for television and can be placed on local television stations by companies that wish to do so. Committee will not show it on any television network. Companies are to make their own arrangements for exhibiting the film. Cost of first print varies from $300 to $900 depending on size of company. Additional prints are $175 each. Committee points out, however, that purchases made hereafter will be subject to extra charge to cover costs of small quantity orders.

Arizona PS Co Offers 'Pattern for Progress'

Organize—Survey—Analyze— Act —These steps are basic in Arizona Public Service Co's "Pattern for Progress," a plan for improving the general welfare of every community in Arizona. With the state leading the nation in percentage of population growth, Public Service feels it is imperative that each community make an effort to attract its share of new people, commerce, and industry.

The 30-page booklet is being offered to the leaders of every community in the state, but not as a cure-all. Pattern for Progress is intended to help diagnose and recognize particular limitations and potentials. Public Service does not plan to tell any community what to do. It merely will offer suggestions as to how a community might benefit by applying the four basic steps.

Organizing an area development committee to steer, publicize, and survey is the first step. Surveying the community to discover its assets, needs, and ways to satisfy the needs then follows. The last half of the booklet includes a questionnaire for planning community development. Climate, government, civic facilities, economy, agricultural and commercial products are phases to be covered. What type of new industry can the community best support and why is also asked.

Analyzing this inventory and planning projects are the third step. Taking appropriate action is the final one. By following through on chosen projects, Public Service feels that every community in Arizona can improve itself and the state as a whole.

Edison Motion Picture Available to Industry

Prints of the historically important motion picture film of Thomas A. Edison, shown at the Edison Electric Institute convention in June, are now available.

The running time of the film is seven minutes. In addition to its continuing value as a unique documentary of the great inventor, addressed specifically to the industry he founded, its elements of general interest should make it useful, on TV and otherwise, to many companies in local celebrations of Light's Diamond Jubilee.

In the first half, filmed in 1929 at Fort Meyers, Fla., Edison briefly reviews his work on the first successful incandescent lamp and his generating and distribution system. In the second he is shown and heard as he greets from West Orange, N. J., in a worldwide radio hook-up, the 1930 convention of NELA at San Francisco and the world power conference at Berlin, Germany.

Print orders should be sent to Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

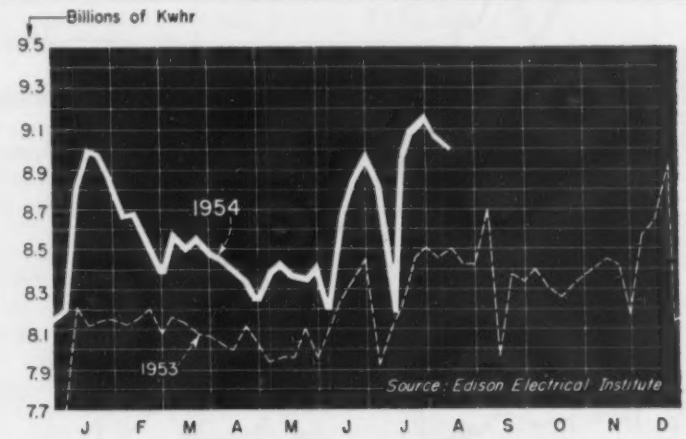
SCANNING THE ADS

Alabama Power Co—"What Happens When Wiring Is at Fault" headed an ad showing six conditions, such as slow-heating irons, slow toasters, frequent fuse blow-outs, which indicate inadequate wiring. Humorous illustrations of the conditions appeared along the sides of the ad whose center portion promoted adequate wiring.

Carolina Power & Light Co has discovered another freedom—freedom of movement which you can enjoy with automatic electrical appliances.

Electric Companies Advertising Program—October ad points out that baby today is born with something far better than a silver spoon in his mouth. Today the spoon is electric instead of silver, and it will help him to live a life that old-time kings would envy.

STATISTICS



Output Week Ended Aug 14—8,996,000,000 Kwhr

Seasonally Adjusted Index†—173.5

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Aug. 14	+5.7	−0.4	−0.2	−4.2	+5.1	+17.4	+14.5	+4.7	+1.9	+3.1
Aug. 7	+7.0	+1.6	+3.6	−3.9	+5.9	+17.6	+14.9	+5.6	+1.8	+6.9
July 31	+7.4	+0.8	+2.4	−3.0	+6.3	+16.4	+20.5	+6.0	+2.1	+7.1

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load ‡(Million Kw)	June	78.0	73.8	73.0
Capacity (Million Kw)	June	95.31	93.81	85.06
Production (Billion Kwhr)	June	38.90	37.43	36.98
Hydro	June	9.59	10.35	9.10
Fuel	June	29.31	27.08	27.88
Fuel Consumption				
Coal (Million Tons)	June	9.29	8.67	9.07
Oil (Million Barrels)	June	4.29	4.25	6.11
Gas (Billion Cu Ft)	June	107.79	94.70	103.73
Sales (Billion Kwhr)	May	31.59	32.31	31.32
Residential	May	9.31	9.93	8.50
Commercial	May	5.62	5.62	5.18
Industrial	May	14.43	14.60	15.49
Other	May	2.23	2.17	2.16
Net Income Class A & B Companies ($ Million)	May	85.46	96.05	82.58
Estimated Dec. '54 Peak ‡(Million Kw)	May	88.1	88.4	91.8
Kwhr per Residential Customer (12 Month Average)	May	2,427	2,415	2,241
Revenue per Kwhr Residential Service (12 Month Average)	May	2.72¢	2.72¢	2.76¢
Canadian Production (Billion Kwhr)	May	5.93	5.65	5.76

Business Statistics

FRB Industrial Production Index†	July	117*	124	129
Gross National Product Annual Rate ($ Billion)	1st Qtr.	355.8	360.5	361.8
EW 4 Industry Production Index†	May	114.9	114.6	126.2
ENR Construction Cost Index††	July	135.0	130.5	126.6
BLS Consumer's Price Index	June	115.1	115.0	114.5
NEMA Insulation Materials Sales Index†	May	116	124	174
NEMA Electric Appliance Sales Index†	May	88	96	108
NEMA Household Refrig. Sales Index†	May	74	73	81
Metal Prices (Aug. 17)				
Copper, Conn., V., lb		$.30	.29¾	.29½
Lead, N. Y., lb		.14	.14	.14
Zinc, prime Western S. St. Louis, lb		.11	.11	.11
Tin, Straits, qual. N. Y. lb		.93½	.97¾	.83
Aluminum, ingot, base price		.21½	.21½	.21½
Nickel, base price		.60	.60	.60
Steel, billets, Pitts., ton		64.00	64.00	62.00
Steel, scrap, No. 1 heavy, Pitts., ton		29.00	28.00	44.00

*Preliminary **Revised ‡Class 1 Systems †1947-49=100 ††1949=100

Economic Indicators Get a Face Lifting Treatment

A new series of figures on National Income and Product are in the works at the Department of Commerce. The new data represents a systematic review of the old series incorporating new material and improved statistical methods. Among the new sources occasioning the remodeling job were the postwar Censuses of Manufactures, Business, Agriculture, Population and Housing.

As an aid in seeing what constitutes the familiar totals, the accompanying table summarizes some of the components and indicates the mutual relationships of the figures.

Relation of GNP, National Income, and Personal Income

		1953 Millions of $
	Gross national product	364,857
Less:	Capital consumption allowances	27,226
	Depreciation charges	24,170
	Accidental damage to fixed capital	808
	Capital outlays charged to current expense	2,248
Equals:	**Net national product**	337,631
Plus:	Subsidies minus current surplus of government enterprises	−529
Less:	Indirect business tax and nontax liability	30,037
	Business transfer payments	1,016
	Statistical discrepancy	1,047
Equals:	**National income**	305,002
Less:	Undistributed corporate profits	8,921
	Corporate profits tax liability	21,144
	Corporate inventory valuation adjustment	−964
	Contributions for social insurance	8,752
	Excess of wage accruals over disbursements	−76
Plus:	Net interest paid by government	5,040
	Government transfer payments	12,785
	Business transfer payments	1,016
Equals:	**Personal income**	286,066
Less:	Personal contributions for social insurance	4,007
Less:	Personal tax and nontax payments	35,967
	Federal	32,484
	State and local	3,483
Equals:	**Disposable personal income**	250,099
Less:	**Personal consumption expenditures**	230,080
Equals:	**Personal saving**	20,019

FINANCIAL

Security Sales . . .

. . . to the public by electric industry topped $1.4 billion in first half of 1954 to set new record, tabulation shows

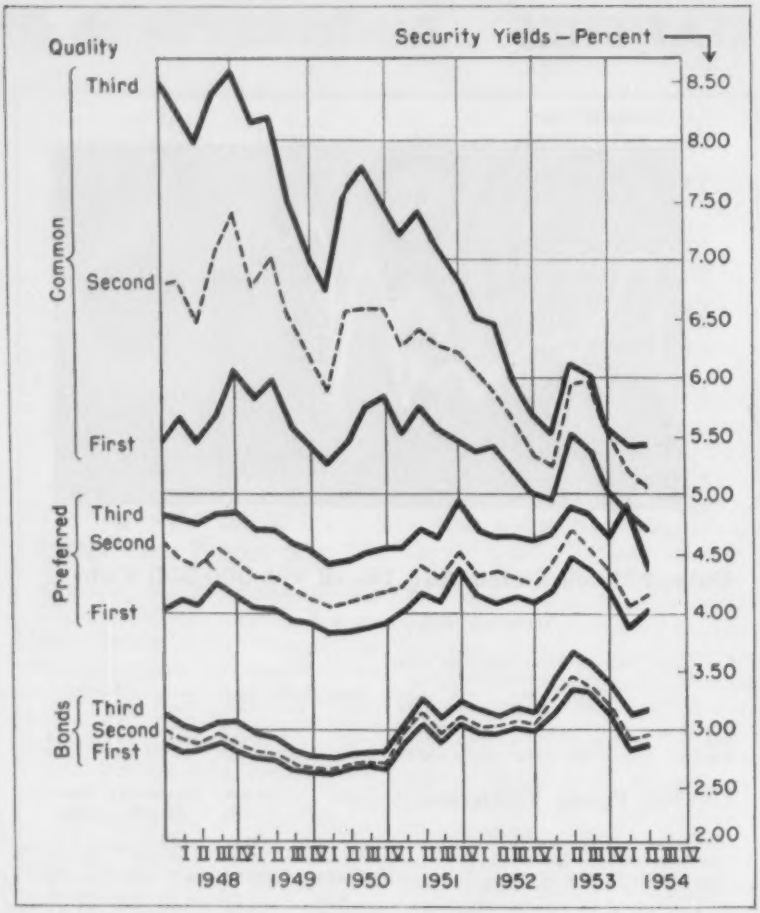
Security sales to the public by electric companies hit a record $1.42 billion in the first six months of 1954. This figure tops the $1.02 billion sold in the like period of 1953.

Debt and preferred stock issues sold directly to institutional purchasers would add about $110 million to this year's total and close to $190 million to last year's amount. In addition the Ohio Valley Electric Corp and the Electric Energy, Inc, delivered bonds in the amount of $103 million during the first half of 1954 under contracts with "private" investors. During entire 1953 $82 million debt money was received by these two companies organized to provide energy to certain government atomic projects.

Interest Rates Dipped Sharply . . . Taking advantage of the sharp decline in interest rates, nearly 20% of the money received from investors this year was used to refund securities, most of which were sold in 1953. On a new money basis, funds raised publicly and privately so far in 1954, exclusive of OVEC and EEI debt sales, came to about the same as last year's figures.

The decline in money rates following a rapid rise during the second quarter of 1953 has been as sharp and as widespread as in the comparable phase of any business downturn since World War I, according to a Federal Reserve Board review of monetary developments since mid-1953. It has extended throughout the credit market, affecting in varying degrees all types of securities.

Yields on short-term securities have typically experienced the sharpest relative changes. In June, 1953, the average yield on new U. S. Treasury bills, the most sensitive of short-term money rates, was 2.23% and in June, 1954, 0.65%, a decline of 70%. At the other end of the Treasury list, the yield on 30-year 3¼% bonds went from 3.29% in June, 1953, to 2.70% in the same month of 1954, a fall in yield of 18%.



Public Offering—Electric Utility Securities
(Thousands of Dollars)

	First Half of 1954			First Half of 1953		
	New Money	Other	Total	New Money	Other	Total
Bonds, Notes, and Debentures	694,504	220,846	915,350	543,200	2,000	545,200
Preferred Stocks	168,403	69,186	237,589	141,992	6,642	148,634
Common Stocks (a)	267,682	.....	267,682	329,109	.....	329,109
Total	**1,130,589**	**290,032**	**1,420,621**	**1,014,301**	**8,642**	**1,022,943**
	Second Quarter of 1954			**Second Quarter of 1953**		
Bonds, Notes and Debentures	281,654	180,846	462,500	343,400	.....	343,400
Preferred Stocks	121,773	69,186	190,959	71,275	6,642	77,917
Common Stocks (a)	142,299	.....	142,299	163,017	.....	163,017
Total	**545,726**	**250,032**	**795,758**	**577,692**	**6,642**	**584,334**

Source: Reis & Chandler, Inc.
Notes—Bonds are taken at principal amount and stocks at the price to the public. (a) Offerings to stockholders under subscription rights are included in same quarter as the date of stock record.

Debt Securities

Company	Refunding Issue Date Sold	Refunding Issue Net Cost*	Refunded Issue Date Sold	Refunded Issue Net Cost*	Change
Commonwealth Edison	April, 1953	3.09%	July, 1953	3.69%	0.67%
Iowa Public Service	May, 1954	3.16	June, 1953	4.13	0.97
Montana Power	May, 1954	3.21	May, 1953	4.36	1.15
Pacific Gas & Electric	May, 1954	3.12	May, 1953	3.97	0.85
California Electric Power	May, 1954	3.27	April, 1953	3.88	0.61
Consumers Power	June, 1954	3.04	July, 1953	3.75	0.71
	Preferred Stock Securities				
Long Island Lighting	April, 1954	4.44%	Nov, 1951	5.39%	0.95%
			May, 1953	5.38	0.94
Public Service E&G	May, 1954	4.18	Nov, 1951	4.71	0.53
Public Service of Indiana	June, 1954	4.25	June, 1953	5.04	0.79

Note—* After deducting from the public offering price, underwriting commissions and estimated expenses, but in case of refunding issues, without allowance for costs of redeeming refunded issues.

Rates charged by banks on short-term loans move more slowly. The "prime rate," charged top-quality borrowers was lowered to 3% in March this year from 3¼% where it had stood since April, 1953.

FRB Credit Easing Measures . . . The ease in money rates reflects Federal Reserve credit easing measures, reduced credit demand, and a continued high rate of saving.

These developments all have a direct bearing on the cost of money the electric company issuing new securities has to pay. A comparison of the net cost of new securities sold (see table on the bottom of page 100) to refund higher cost issues reveals the extent of the saving realized within the space of but 12 months, in most instances.

With more and more cash going into savings banks, insurance companies, trust accounts, and pension funds, the problem of profitable investment becomes more difficult for these depositaries as available qualified senior obligations are taken off the market. In order to obtain a reasonable return, there are more investment funds going into common stock issues of well established concerns.

Common Stock Yields Off Sharply . . . This is brought out on the chart showing Reis & Chandler's average yields. Over the 12 months to June 30, 1954, the average yield of first and second quality common stocks has declined approximately 15%, while the yield on the third quality issues has dropped 10%. They now stand at the lowest levels since around the time of the 1946 stock market peak.

As measured by the Dow-Jones utility average, utility stock prices at the middle of this year were 20% above mid-1953 and 12% higher than the level at the end of 1953. But in contrast to heavier senior security sales this year, money raised through common stock offerings totalled $268 million during the first six months of 1954 compared with $329 million in the same period last year. Some companies may be holding back doing any common stock financing until earnings improve.

While earnings' experience of electric companies differ widely, a comparison of the income figures of some

(*Continued on page* 204)

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
Aug. 12	**2.85**	**2.90**	**3.11**	**3.97**	**4.07**	**4.42**	**4.44**	**4.70**	**5.05**
Aug. 5	2.86	2.92	3.15	3.98	4.09	4.42	4.38	4.70	5.04
END OF QTR.									
2nd 1954	2.90	2.96	3.19	4.03	4.14	4.48	4.72	5.04	5.45
1st 1954	2.82	2.87	3.14	3.88	4.09	4.42	4.83	5.19	5.42
4th 1953	3.07	3.12	3.34	4.17	4.32	4.62	5.07	5.57	5.51
3rd 1953	3.30	3.33	3.54	4.35	4.52	4.83	5.36	5.57	6.01

Data: Reis & Chandler, Inc.

EARNINGS

Company	Period Months Ended		Net Income 1954	Net Income 1953	Earnings per Common Share 1954	Earnings per Common Share 1953
California Pacific Utilities	12	June	$616,722	$547,304	2.10(a)	2.03(a)
Community Public Service	12	June	1,287,199	1,265,685	....	....
Dallas Power & Light	12	June	5,117,786	4,645,118	....	....
Delaware Power & Light	12	June	4,485,292	3,927,747	1.99(b)	1.93(b)
Gulf States Utilities	12	June	9,490,267	8,355,051	1.88	1.62
Interstate Power & subsidiaries	12	June	2,495,764	2,453,783	.93(c)	.92(c)
Iowa-Illinois Gas & Electric	12	June	4,218,405	4,703,190	2.04	2.42
Shawinigan Water & Power	6	June	3,116,709	2,967,546	1.19	1.12
Utah Power & Light	12	June	5,056,359	4,997,945	2.48(f)	2.71(f)

Notes—(a) Based on 231,102 shares in 1954 and 227,824 shares in 1953; (b) Based on 1,858,429 shares in 1954 and 1,627,640 shares in 1953; (c) Based on total outstanding shares at end of period, and (f) Based on 2,042,500 shares.

FINANCIAL

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF AUGUST 12-18			
Bonds			
Consumers Public Power District, Neb.—western system revenue bonds due 1956-80	$2,250	various	1.00-2.60%
Manitowoc, Wis.—electric revenues due 1955-74	1,250	various	0.65-1.80
New Jersey Power & Light—1st mtg 3¼% due 1984	8,700	101.25%	3.06
Southern California Edison—1st mtg 3% due 1979	30,000	100.526	2.97
Preferred Stock			
Missouri Public Service—50,000 sh 4.30% $100 par	5,000	$100.00	4.30%
SCHEDULED FOR AUGUST—SEPTEMBER—OCTOBER			
Bonds and Debentures			**Bid Date**
Niagara Mohawk Power—1st mtg due 1984	$25,000	.....	Aug. 24
Arkansas Power & Light—1st mtg due 1984	7,500	.....	Aug. 24
Lower Colorado Power Authority, Tex.—revenue refunding due 1955-62	27,000	.....	Aug. 24
Los Angeles, Calif., Department of Water and Power—electric revenues due 1955-84	19,500	.....	Sept. 8
Montana-Dakota Utilities—1st mtg due 1979	5,000	.....	Sept. 8
Montana-Dakota Utilities—1st mtg due 1956-75	7,000	.....	Sept. 8
Northern States Power (Minn.)—1st mtg due 1984	20,000	.....	Sept. 28
Columbus & Southern Ohio Electric—1st mtg	10,000	.....	Sept. 29
Indiana & Michigan Electric—1st mtg	16,500	.....	Oct. 5
Wisconsin Power & Light—1st mtg	18,000	.....	Oct. 5
Sierra Pacific Power—1st mtg	4,000	.....	Oct. 8
Savannah Electric Power—1st mtg	5,000	.....	Oct. 26
Savannah Electric Power—debs	3,000	.....	Oct. 26
Public Service Co of Colorado—1st mtg due 1984	20,000	.....	.....
Dayton Power & Light—1st mtg due 1984	15,000	.....	.....
Preferred Stock			
Northern States Power—200,000 sh $100 par	$20,000	.....	Aug. 24
Oklahoma Gas & Electric—75,000 sh $100 par	7,500	.....	Sept. 14
Tampa Electric—50,000 sh $100 par	5,000	.....	Sept. 22
Indiana & Michigan Electric—40,000 sh $100 par	4,000	.....	Oct. 5
Savannah Electric & Power—30,000 shs $100 par	3,000	.....	Oct. 26
Atlantic City Electric—72,000 sh $100 par	7,200	.....	.....(b)
Common Stock			
California Electric Power—170,000 sh	.....	.....	Aug. 31
Columbus & Southern Ohio Electric—200,000 shs	.....	.....	Sept. 20
San Diego Gas & Electric—800,000 sh	.....	.....	.....
Sierra Pacific Power—34,807 shs (to be offered commonholders, record about Oct. 6 to expire Oct. 22)	.....	.....	.....
ISSUES RECENTLY POSTPONED			
Bonds			
Gulf States Utilities—1st mtg due 1984	$24,000	.....	.....
Consolidated Edison Co of N. Y.—1st mtg due 1984	50,000	.....	.....
Preferred Stock			
California Electric Power—105,000 sh $50 par	$5,250	.....	.....(a)
Gulf States Utilities—160,000 sh $100 par	16,000	.....	.....

Notes—(a) Temporarily postponed; Merrill Lynch, Pierce, Fenner & Beane group, underwriters; and (b) Probably be sold privately through Union Securities Corp group.

WASHINGTON COMMENT

JESSE MOCK

GOP Gives REA an Agonizing Reappraisal

On a dollar basis the federal rural electrification and telephone loan programs fall considerably short of being self-sustaining activities.

During its first 17 years the Rural Electrification Administration, which administers the loan programs, cost the taxpayer some $80 million for which there is no prospect of direct return to the U. S. Treasury. This does not include all the losses that may be sustained in connection with interest collections on the nearly $2 billion which REA has advanced in loans for construction of electric and telephone facilities.

These figures are from the recently released audit of REA operations prepared for Congress by Acting Comptroller General Frank H. Weitzel, who is Congressional watchdog over the U. S. Treasury. The searching, legalistic report covers the financial activities of REA through June 30, 1952, but additional commentary brings the report somewhat more up to date.

The report lists these items which REA borrowers are not required to cover in their loan repayments or which may be lost as a result of loan delinquencies:

Administrative expenses	$66,944,448
Services from other agencies	11,000,000
Estimated losses on loans	1,831,176
Office furniture	481,511
Total	**$80,257,135**

It is fair to point out that an REA reorganization in progress at the time these figures were put together was aimed at cutting the costs on continuing loan services, which go under administrative expense. Several of the services formerly furnished free of charge to borrowers are now borne by the borrowers themselves. These include auditing and engineer inspection assistance.

Helps in Building Load . . . However, the present REA administration is banking on rendering assistance in the load-building and other activities designed to increase the security of electrification and telephone loans.

For the time being the "estimated losses on loans" remains pretty much of a theoretical figure. REA can point out that actual losses on defaulted loans during the first 17 years of the programs amounted to a trifling $44,478 and argue there is no real basis for estimating future losses.

On the other hand the comptroller's report comments: "We believe that this estimate (of $1,831,176) may be substantially understated, particularly because of the increasing debt repayment requirements confronting about one-fourth of the borrowers which are showing current and accumulated operating deficits."

Only specific recommendations to Congress in connection with REA operations is that consideration be given to revising or abolishing the state loan fund allotment formula. This provides for the allotment of 50% of REA's annual electrification loan funds to states on the basis of unelectrified farms in each state. The remaining 50% and any unused funds carried over from preceding years may be loaned at the discretion of the administrator provided that no more than 10% thereof is loaned in any one state or in all of the territories.

Unbalanced Allotments Unlikely . . . The acting comptroller notes that REA has had difficulty in determining the number of unelectrified farms on a state-by-state count. Further it notes that most states can now boast extensive rural electrification and do not need protection against unbalanced allotments to other states.

However, the present REA administration argues that elimination of the formula would deprive Congress and REA of necessary and desirable controls over the distribution of electrification loan funds and would encourage recurrent pressures for the commitment of very substantial amounts of loan funds in individual states.

The audit report also highlights REA's novel interest collection policy, which it estimates will result in the collection of some $56 million less interest than if the normal collection method were used.

The REA method works like this: On most long-term loans (generally 35 years) the agency does not require borrowers to make payments of interest or principal until the sixth year of the loan period. When payments are begun, each quarterly installment during the remaining 30 years includes an amount for current interest and principal and an additional amount to pay off a portion of the interest accrued during the first five years of the loan.

This procedure permits the application of loan collections to principal indebtedness before all accrued interest has been paid. Normal method for collecting interest in the United States is to apply payments first to the liquidation of accrued interest and the remainder to principal.

On outstanding loans, the report estimates that borrowers stand to save $56 million under the REA collection policy which was adopted in 1944 by the agency.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Energia es necessari pro toto que occurre in le mundo. In tempores passate le plus grande parte del energia applicate essera fornite per le fortia muscular del hommes e del animales domestic. This is Interlingua—a new international language for scientists made up of English, French, Spanish, Portugese, and German—For . . .

. . . **Energy is necessary** for all that occurs in the world. In past times the greatest part of the applied energy was furnished by the muscular strength of men and domestic animals.

Binder tape on self-supporting aerial cable and lashing wire for spinner installations hold the cable to the messenger and provide a grounded path outside the cables which sometimes allows use of unshielded cables at the higher voltages.

Standard ambient temperature (40C, 104 F) is exceeded only at Yuma, Ariz. Elsewhere the margin is a contribution to longer than normal insulation life.

Trends in Distribution

For Rural and Residential Areas

Electrical World's Regional Summary Shows...

- *Swing to 12 & 13 kv primaries strongest in West South Central*
- *Aluminum leads in Mountain States*
- *Field-fabrication dominates South Atlantic substations*
- *Voltage regulation stressed in Middle Atlantic and Rural Co-ops*
- *Service voltage holds at 120/240*

Bolstered by data from 28 additional utilities and 17 rural cooperatives, Electrical World's survey of distribution trends includes 107 organizations serving 63% of the nation's meters. Their operating areas include 42 states, well distributed among the nine geographic areas.

Almost universally these utilities are retaining their established practices in areas already extensively developed. But many have initiated changes in new rural and residential areas. Many more envision such changes within a few years.

Outstanding is the trend to higher distribution voltage. The enlarged group of utilities sustains the previously reported (EW May 17 p 133) trend to 42% at 12.47 and 17% at 13.8 kv. A second utility contemplates going 23 kv. The coops are already in these voltage brackets.

No reply indicates significant deviation from the present 120/240 service voltage. But two or three utilities suggest that 400 v or higher may be considered subsequently.

ACSR and aluminum, usually bare, trend upward respectively to 45 and 9% acceptance for utility primaries, compared with 36 and 2% today. For secondaries, the figures are 28% ACSR and 26% aluminum, up from 20 and 12% respectively. The rapid trend from 34% today to a future 55% for preassembled service cable boosts use of aluminum and ACSR here to a future 64%.

Voltage regulation is expected to depend increasingly on primary capacitors for 61% of feeders, up from 51% today. Installations switched by voltage or time clocks account for most of this change. Secondary capacitors are expected to advance from 4.6 to 8%, but mostly in the southern states.

Use of individual feeder regulators is expected to decline in favor of tap changers on substation transformers. Here the 5,000 kva rating retains preferred position, but the 7,500 and 10,000 displace the 2,500 and 3,750 for second choice. Field assembly remains the preferred construction practice, but yields slowly as unit stations gain acceptance.

Many more important trends are revealed by the survey replies. For those who wish to explore further, condensed versions of the data are tabulated by geographical groups. Changes between present practices and future trends are **bold faced.**

East North Central Utilities...

With annual expenditures for distribution in the East North Central area approaching 20% of the industry total, its trends weigh heavily in the national pattern. Data report the practices and trends of 11 utilities serving 60% of the area's meters. Annual load growth for them ranges from 7 to 15% in rural sections and 8 to 50% in new residential areas. The 11% average coincides with the national trend.

Today's practices build heavy distribution circuits with feeder conductors ranging upward from No. 4 equivalent to 350 Mcm. Despite relative reluctance to use 12.47 and 13.2 kv for distribution (30% today trending to 45% in the future compared with a 59% national trend), their

Future Trends in Distribution are Revealed in These Data

System type; Load growth; Co	Rural; 10%; 1	Rural; 10%; 2	Rural; 10%; 3	Rural; 7%; 4	Rural; 15%; 5
PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	12 Ygnd; Joint	12.47 Ygnd; Joint	12.5 Ygnd; Joint	**12.5 Ygnd;** No	**12.47 Ygnd;** No
Feeder conductor; Kva rating	. . . ACSR; . . .	**2 eq** ACSR; **3,000**	2 eq ACSR; **2,200**	**4** eq ACSR; 1,000	2 eq ACSR; **2,500**
Cable req'd by; Type preferred	. . . ; . . .	Not; None	Econ.; Non met.	Not; None	Trees; Non met.
Lateral conductor type; Metal, %	Bare; ACSR 100	Bare; ACSR 100	Bare; **ACSR 85, Al 5, Cu 10**	Bare; ACSR 100	Bare; ACSR 100
Maint. (D)e-energ., (R)ubber, (H)ot stick	H	R, H	. . .	**H**	**H**
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	5 to 167 (**10**)	**5 to 50 (5)**	10 to 100 (15 & 25)	**5 to 50 (5)**	5 to 25 (5)
Preferred type; Load (S)um., (W)int., %	Conv; 125S, 150W	Conv; 130S, 160W	Int. bkr; 140S, 175W	Conv; 150S, 150W	Int. bkr; 150S, **200W**
Overload relieved by	Repl. tsf., cut spacing	Repl. tsf.	Repl. tsf., cut spacing	Repl. tsf.	Repl. tsf.
Taps req'd for voltage; Trend to 3ph	No; No	No; **Possible**	No; Yes	No; No	No; No
Ratings purch 3ph (Most common)	None	None	15 to 150 (30 to 150)	None	None
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	. . . bare; ACSR 100	**. . . preass.; Al 100**	2 eq cov'd.; **Al 80, Cu 20**	6 eq bare; ACSR 100	**4** bare; Cu 100
Banked; Networked; % 3ph	No; No; 0	No; No; **Possible**	Yes; Yes; **1**	No; No; 0	No; No; 0
Min. service size; Metal, %	6 eq; Al 100	**4 eq; Al 100**	6 eq; **ACSR 95, Cu 5**	6; Cu 100	6 eq; **Al 100**
Services, % (W)ire, (C)able, (P)reass.	50W, 50P	**100P**	**100W**	100W	**100P**
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	100F	100F	90F, 5I, 5U	100F	100F
Transformer bank SC kva	. . .	1,500	**7,500, 10,000**	**5,000** to 7,500	1,000 to **3,750**
Subtransmission kv	22 to 132	46	23, 34, 69	34, 69	34.5
Normal load limit (S)um., (W)int., %	ASA	115S, 125W	. . . , 125W	120S, 120W	125S, **140W**
Emerg. load limit (S)um., (W)int., %	ASA	150S, 165W	. . . , 150W	120S, 120W	140S, 170W
Sq mi/substa.; No. feeders/substa.	. . . ; . . .	. . . ; . . .	. . . ; **4**	**75**; 2	150; 1
Exits, % (W)ire, (A)erial, (B)uried, (D)uct	100W	. . .	95W, 5D	100W	100W
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	Yes; 0	. . .; 60	No; 80	No; **50**	No; **25**
% Fdrs. with pole-mtd. (R)egulators;	R 50	R 20	**R 5**	**R 10**	R 20
(P)ri. capac.; (S)ec. capac.	**P 10;** S 0	**P 5;** S 0	**P 80;** S 0	**P 100; S Poss.**	P 100; S 0
% Primary capacitors—Unswitched;	. . .	**95**	100	100	100
Switch by (T)ime; (V)olt; (A)mp; (O)ther	V 100	**V 5**	None	None	None
SERVICE RELIABILITY					
Criterion	None	None	. . .	. . .	. . .
(F)uses, (R)eclosers, (S)ectionalizers,(L)ine stds.	F, R, S, L	F, R	F, R, S, L	F, R, S	F, R, S, L
Pickup switching; Feeder plan provides	**Automat.**; Ties	None; Ties	Manual; . . .	None; Nothing	Man.; Ties, **network**

Today's Practices Build Their

PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	12 Ygnd; Joint	12.47 Ygnd; Joint	12.5 Ygnd; Joint	7.2 delta; No	**4.16 Ygnd;** No
Feeder conductor; Kva rating	. . . ACSR, bare; . . .	**4 eq** ACSR; **1,500**	2 eq ACSR; **1,800**	**4** eq ACSR; 1,000	2 eq ACSR; **300**
Cable req'd by; Type preferred	. . . ; . . .	Not; None	Econ.; Non-met.	Not; None	Trees; Non-met.
Lateral conductor type; Metal, %	Bare; ACSR 100	Bare; ACSR 100	Bare; **ACSR 40, Cwd 10, Cu 50**	Bare; ACSR 100	Bare; ACSR 100
Maint. (D)e-energ.; (R)ubber, (H)ot stick	H	R, H	. .	**R**	**R**
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	5 to 167 (**5**)	**3 to 50 (3)**	10 to 100 (15 & 25)	**3 to 37½ (3)**	5 to 25 (5)
Preferred type; Load (S)um., (W)int., %	Conv; 125S, 150W	Conv; 130S, 160W	Int. bkr; 140S, 175W	Conv; 150S, 150W	Int. bkr; 150S, 200W
Overload relieved by	Repl. tsf., cut spacing	Repl. tsf.	Repl. tsf., cut spacing	Repl. tsf.	Repl. tsf.
Taps req'd for voltage; Trend to 3ph	No; No	No; **No**	No; Yes	No; No	No; No
Ratings purch 3ph (Most common)	None	None	15 to 150 (30 to 150)	None	None
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	. . . bare; ACSR 100	**. . . cov'd; ACSR 75, Cu 25**	2 eq cov'd; **Al 5, Cu 95**	6 eq bare; ACSR 100	4 bare; Cu 100
Banked; Network; % 3ph	No; No; 0	No; No; 0	Yes; Yes; 0	No; No; 0	No; No; 0
Min. service size; Metal, %	6 eq; Al 100	**4 eq; Al 50, ACSR 25, Cu 25**	6 eq; **ACSR 5, Cu 95**	6 eq; Cu 100	6; **Cu 100**
Services, % (W)ire, (C)able, (P)reass.	50W, 50P	**50W, 50P**	**99.5W, 0.5C**	100W	**100W**
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	100F	100F	90F, 5I, 5U	100F	100F
Transformer bank SC kva	. . .	1,500	**3,750, 5,000**	**3,000** to 7,500	1,000 to 2,500
Subtransmission kv	22 to 132	46	23, 34, 69	34, 69	34.5
Normal load limit (S)um., (W)int., %	ASA	115S, 125W	. . . , 125W	120S, 120W	125S, 140W
Emerg. load limit (S)um., (W)int., %	ASA	150S, 165W	. . . , 150W	120S, 120W	140S, 170W
Sq mi/substa.; No. feeders/substa.	. . . ; . . .	. . . ; . . .	. . . ; **2**	**150**; 2	150; 1
Exits, % (W)ire, (A)erial, (B)uried, (D)uct	100W	. . .	95W, 5D	100W	100W
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	Yes; 0	. . .; 60	No; 80	No; **20**	No; **40**
% Fdrs. with pole-mtd. (R)egulators;	R 50	R 20	**R 2**	**R 5**	R 20
(P)ri. capac.; (S)ec. capac.	**P 1;** S 0	**P 1;** S 0	**P 40;** S 0	**P 75; S 0**	P 100; S 0
% Primary capacitors—Unswitched;	. . .	**99**	100	100	100
Switch by (T)ime; (V)olt; (A)mp; (O)ther	V 100%	**V 1**	None	None	None
SERVICE RELIABILITY					
Criterion	None	None	. . .	. . .	. . .
(F)uses, (R)eclosers, (S)ectionalizers,(L)ine stds.	F, R, S, L	F, R	F, R, S, L	F, R, S	F, R, S, L
Pickup switching; Feeder plan provides	**Manual**; Ties	None; Ties	Manual; . . .	None; Nothing	Manual; Ties

feeder ratings average 2,500 kva with 2,970 anticipated.

High use of aluminum appears in these primary circuits. Already 63% ACSR and 3% aluminum, the trend is to 60% ACSR and 10% aluminum. Secondaries, now 20% each aluminum and ACSR, are expected to approach 46% aluminum, 14% ACSR.

Substation transformer banks today extend upward to 25,000 kva with 2,500 to 5,000 the preferred range. Predictions indicate decreasing use of 2,500 and 3,000 kva banks with compensating increases in the 5,000 to 7,500 kva range. Number of feeders per substation is larger than usual, trending toward an average somewhat over 6 from

From 10 Individual Electric Utility Companies

Rural; 15%; 6	Rural; 10%; 7	Rur. & Res.; 11%; 8	Rur. & Res.; 7½%; 9	Rur. & Res.; 9%; 10	Res.; . . .; 1	Res.; 10 to 60%; 2
8.32 Ygnd; Joint 2 eq ACSR; 2,000 Not; None Bare; ACSR 50, Cu 50 R	4.8 delta; Joint 1/0 eq ACSR; 1,000 Not; None Bare; ACSR 100 R	13.2 Ygnd; Joint 4/0 eq ACSR; 5,000 Trees; Non-met. Bare; ACSR 100 H	4.8 delta; Joint 4/0 eq Al; 2,250 Congest.; Lead Bare; Al 55, ACSR 25 R	4.16 Ygnd; Joint 2/0 eq Al; 1,875 Trees; Non-met. Cov'd; Al 25; Cu 75 R	12 Ygnd; Joint 2/0 eq Al; 7,000 . . .; . . . Bare; ACSR 100 H	12.47 Ygnd; Joint 1/0 eq ACSR; 3,500 Trees; . . . Bare; ACSR 100 R, H
10 to 100 (10) Conv; 135S, 150W Repl. taf. No; No None	5 to 167 (15) Ld. ind; . . ., 150W Repl. taf. No; No None	10 to 75 (50) Int. bkr; . . ., 140W Cut spacing . . .; Yes Possible	15 to 167 (25) Conv; 125S, 150W Cut spacing, repl. taf. No; Yes 9 to 500 (15)	10 to 167 (37½) Conv; 110S, 135W Cut spacing, repl. taf. No; Yes 15 to 225 (75)	5 to 50 (15) Conv; 125S, 150W Repl. taf., cut spacing No; No; None	10 to 50 (25) Conv; 130S, 160W Repl. taf., cut spacing No; Possible . . .
2 eq cov'd; Al 50, Cu 50 No; No; 10 6 eq; Al 50, Cu 50 90W, 10P	4 eq cov'd; Al 95, Cu 5 No; No; 3 6 eq; Al 67, ACSR 33 100P	2 eq cov'd; Al 50, Cu 50 No; No; 10 6 eq; Al 67, ACSR 33 100P	2 eq cov'd; ACSR 45, Cu 55 No; No; 1 6 eq; ACSR 20, Cu 80 100W	2 cov'd; Cu 100 Yes; No; 1 8; Cu 100 90W, 10P	1/0 eq cov'd; Al 100 No; No; 0 4 eq; Al 100 100P	2 eq pre-ass.; Al 100 Yes; No; Possible 4 eq; Al 100 100P
75F, 25U 3,750 26.4 100S, 135W 125S, 150W 16; 9 75W, 25D	80F, 20U 1,500 40 75S, 75W 150S, 150W 40; 3 to 6 90W, 5B, 5D	100F 7,500 to 25,000 40, 138 100S, 100W 200S, 200W 20; 2 to 9 35W, 65D	80I, 20U 2,500, 5,000 34.5 125S, 125W 150S, 150W 6 to 50; 2 to 16 10W, 90D	100U 3,750 33, 66 . . .; 100W 110S, 120W 12; 6 to 8 100D	95F, 10U . . . 22, 66 ASA ASA . . .; . . . 60W, 40D	95F, 5I 1,500 to 5,000 46 115S, 125W 150S, 165W . . .; . . . . . .
No; 4 R 20 P 100; S 0 50 T 50	No; 70 R 33 P 50; S 0 80 A 20	Yes; 25 R 15 P 100; S 5 75 T 25	Yes; 70 R 1 P 40; S 0 80 V 20	No; 85 R 10 P 100; S 8 96 T 1; V 3	Yes; 0 . . . . . . 100 None	No; 60 R 1 P 60; S 0 95 V 5
. . . F, R, S, L Manual; Ties	. . . F, R, S Man., auto.; Ties	Probable F, R, S, L Man., auto.; Ties	1 Interruption/yr F, R, L Man.; Spare fdr., ties	None F, R Manual; . . .	None . . . Automat.; Ties	None F, R Manual;Ties

Distribution for Tomorrow's Loads

4.8 delta; Joint 1/0 Cu; 1,200 Not; None Bare; Cwd 15, ACSR 10, Cu 75 R	4.8 delta; Joint 2 eq ACSR; 750 Not; None Bare; ACSR 100 R	13.2 Ygnd; Joint 4/0 eq ACSR; 5,000 Not; None Bare; ACSR 100 H	4.3 delta; Joint 4/0 eq Al; 2,250 Congest.; Lead Cov'd; Cu 84 Al 13, ACSR 3 R	4.16 Ygnd; Joint 2/0 Cu; 1,875 Trees; Non-met. Cov'd; Al 5, Cu 95 R	12 Ygnd; Joint 2/0 eq Al; 7,000 . . .; . . . Bare; ACSR 100 H	8.3 Ygnd; Joint 1/0 eq; ACSR; 3,500 . . .; . . . Bare; ACSR 100 R, H
5 to 50 (5) Conv; 135S, 150W Repl. taf. No; No None	5 to 100 (5) Conv; . . ., 150W Repl. taf. No; No None	5 to 100 (25) Int. bkr; . . ., 140W Cut spacing . . .; No None	10 to 150 (15) Conv; 125S, 150W Cut spacing, repl. taf. No; Yes 10 to 500 (10)	5 to 167 (15) Conv; . . ., 167W Cut spacing, repl. taf. No; Yes 15 to 225 (75)	5 to 50 (15) Conv; 125S, 150W Repl. taf., cut spacing No; No None	10 to 50 (15 & 25) Conv; 130S, 160W Repl. taf., cut spacing No; No None
4 eq cov'd.; Al 5, Cu 95 No; No; 2 6 eq; Al 5, Cu 95 99W, 1P	4 eq cov'd.; Al 90, Cu 10 No; No; 1 6 eq; Al 67 ACSR 33 100P	2 cov'd.; Cu 100 No; No; 1 6 eq; Al 1, Cu 99 99W, 1P	2 eq cov'd.; ACSR 25, Cu 75 No; No; 1 8 eq; ACSR 10, Cu 90 100W	2 cov'd.; Cu 100 No; No; 1 8; Cu 100 100W	1/0 eq cov'd.; Al 100 No; No; 0 6 eq; Al 100 100P	2 cov'd.; ACSR 75, Cu 25 Yes; No; 0 4 eq; Al 50, ACSR 25, Cu 25 50W, 50P
100F 2,500 26.4 100S, 135W 125 S, 150W 25; 3 100W	100F 1,500 40 100S, 100W 120S, 125W 50; 2 to 3 100W	100F 5,000 to 25,000 40, 138 100S, 100W 200S, 200W 25; 2 to 9 40W, 60D	20F, 80I 2,500, 5,000 34.5 125S, 125W 150S, 150W 6 to 50; 2 to 20 10W, 90D	100U 3,750 33, 66 . . .; 100W 110S, 120W 12 to 15; 4 100D	100U . . . 22 to 66 ASA ASA . . .; . . . 60W, 40D	100F 1,500 to 5,000 46 115S, 125W 150S, 165W . . .; . . . . . .
No; 4 R14 P 40; S 0 100 None	No; 50 R 33 P 2; S 0 100 None	Yes; 2 R 15 P 95; S 0 100 None	Yes; 70 R 1 P 20; S 0 80 V 20	No; 97 R 20 P 100; S 0 99.3 T 0.4; V 0.3	Yes; 0 . . . . . . 100 None	No; 60 R 1 P 35; S 0 100 None
. . . F, R, S, L Manual; Ties	. . . F Man., auto.; Ties	None F, R, S, L None; Ties	1 Interruption/yr F, R, L Man.; Spare fdr., ties	None F, R Manual; . . .	None . . . Manual; Ties	None F, R Manual; Ties

about 4 today. Construction shows 3 to 1 preference for field assembly with little indication of future change.

Distribution transformers for this area show clearly the trend toward larger units. Nearly half the replies report 15 kva the most common purchase today and over half predict 25 kva or larger for the future. But 5 kva is the minimum for 70% of the companies today and 35% in the future. Conventional transformers are the 2.3 to 1 preference of these utilities, a marked deviation from national trends. But interest in three-phase units runs somewhat above the national trend with four utilities already using them in certain sizes.

Future Trends in Distribution are Revealed in These Data

System type; Load growth; Co	Res.; 10%; 6	Res.; 10 to 15%; 7	Res.; 10%; 3	Res.; 8%; 4	Res.; 10%; 5
PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	8.32 Ygnd; Joint	4.8 delta; Joint	4.16 Ygnd; Joint	4.16 Ygnd; Joint	4.16 Ygnd; Joint
Feeder conductor; Kva rating	4/0 eq **ACSR; 3,000**	4/0 eq **Al**; 2,000	4/0 Cu; **2,200**	1/0 Cu; 1,700	350 MCM Cu; 2,700
Cable req'd by; Type preferred	Trees; Lead	Congest.; **Shielded**	Econ.; Non-met.	Not; None	Appear., trees; Lead
Lateral conductor type; Metal, %	Bare; **ACSR 50, Cu 50**	Cov'd; **Al 20, Cu 80**	Bare; . . .	Cov'd; Cu 100	Cable; **Cu 100**
Maint. (D)e-energ., (R)ubber, (H)ot stick	R	R	. . .	R	D, **R**
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	37½ to **100** (37½)	15 to **167** (**25**)	10 to **150** (**15 & 25**)	10 to 100 (**25**)	15 to **75** (37½)
Preferred type; Load (S)um., (W)int., %	Conv; 135S, 150W	Conv; . . ., 150W	Int. bkr; 140S, 175W	Conv; 150S, 150W	Int. bkr; Sig. light
Overload relieved by	Repl. tsf., cut spacing	Repl. tsf.	Repl. tsf., cut spacing	Cut spacing	Cut spacing, repl. tsf.
Taps req'd for voltage; Trend to 3ph	No; Yes	No; No	No; Yes	No; No	. . .; No
Ratings purch 3ph (Most common)	25 to 167 (**75**)	None	15 to 150 (30 to 150)	None	**50** to **100** (**75**)
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	2 eq cov'd; Al 85, Cu 15	2 eq cov'd; **Al 95, Cu 5**	2 eq cov'd; **Al 80, Cu 20**	2 cov'd; Cu 100	2 eq cable; Cu 70, Al 30
Banked; Networked; % 3ph	No; No; **10**	Yes; No; **10**	Yes; Yes; **5**	No; No; **2**	Yes; No; **5**
Min. service size; Metal, %	6 eq; Al 95, Cu 5	6 eq; Al 67, ACSR 33	6 eq; **ACSR 95, Cu 5**	6; Cu 100	6 eq; Al 50, Cu 50
Services, % (W)ire, (C)able, (P)reass.	**40W, 60P**	100P	**100W**	100W	100P
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	**25 I, 75U**	80F, 20I	90F, 5I, 5U	100F	100U
Transformer bank SC Kva	**5,000**	**7,500**	**7,500 & 10,000**	**5,000** to **7,500**	**5,000**
Subtransmission Kv	26.4	24, 40	23, 34, 69	34.5, 69	34.5
Normal load limit (S)um., (W)int., %	100S, 135W	72S, 75W	. . ., 125W	120S, 120W	132S, 152W
Emerg. load limit (S)um., (W)int., %	125S, 150W	145S, 150W	. . ., 150W	160S, 160W	161S, 178W
Sq mi/substa.; No. feeders/substa.	**3; 16**	**4; 12**	. . .; **4**	**2 to 3; 6**	1; 4
Exits % (W)ire, (A)erial, (B)ured, (D)uct	**10W, 90D**	100D	95W, 5D	**100W**	90B, 10D
VOLTAGE REGULATION					
Substa. tap change; % Fdrs with regulators	Yes; 20	. . .; 0	**No**; 80	No; **50**	Yes; 0
% Fdrs with pole-mtd (R)egulators;	R 3;	R 5;	R 0;	R 1;	R 0;
(P)ri. capac.; (S)ec. capac.	P 100; S 0	**P 50**; S 0	**P 90**; S 0	P 100; **S Possible**	P 0; S 0
% Primary capacitors—Unswitched,	**20**	None;	100;	. . .;	**20**;
Switch by (T)ime; (V)olt.; (A)mp; (O)ther	**T 80**	T 100	None	. . .	T 80
SERVICE RELIABILITY					
Criterion	. . .	. . .	. . .	. . .	. . .
(F)uses ,(R)eclosers, (S)ectionalizers, (L)ine stds.	F, R, **S**, L	None	F, R, S, L	F, L	F, R, L
Pickup switching; Feeder plan provides	Manual; Ties	Manual; Ties	Manual;	None; . . .	None; Network

Today's Practices Build Their

PRIMARY CIRCUITS					
Kv. ph to ph; Joint with tel.	**3.8** Ygnd; Joint	**4.8 delta**; Joint	4.16 Ygnd; Joint	**4.16 Ygnd**; Joint	**4.16** Ygnd; Joint
Feeder conductor; Kva rating	4/0 **Cu**; **1,350**	4/0 **Cu**; 2,000	4/0 Cu; **1,800**	1/0 Cu; 1,700	350 MCM Cu; 2,700
Cable req'd by; Type preferred	Trees; Lead	Congest.; **Lead**	Econ.; Non-met.	**Not**; **None**	Appear., trees; Lead
Lateral conductor type; Metal, %	Bare; **Cu 100**	Cov'd; **Al 10, Cu 90**	Bare; ACSR 15, Al 5, Cu 80	Cov'd; Cu 100	Cable; **Al 5, Cu 95**
Maint. (D)e-energ., (R)ubber, (H)ot stick	R	R	. . .	R	D
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	**25 to 50** (**25**)	15 to **100** (**15**)	10 to **100** (**10 to 25**)	10 to 100 (**15 & 25**)	15 to **50** (**25**)
Preferred type; Load (S)um., (W)int., %	Conv.; 135S, 150W	Conv.; . . ., 150W	Int. bkr.; 140S, 175W	Conv., 150S, 150W	Int. bkr.; Sig. light
Overload relieved by	Repl. tsf., cut spacing	Repl. tsf.	Repl. tsf., cut spacing	Cut spacing	Cut spacing, repl. tsf.
Taps req'd for voltage; Trend to 3ph	No; Yes	No; No	No; Yes	No; No	. . .; No
Ratings purch 3ph (Most common)	25 to 167 (**50**)	None	15 to 150 (30 to 150)	None	**None**
SECONDARIES & SERVICE DROPS					
Ruling sec. conductor; Metal, %	**4** eq cov'd; Al 85, Cu 15	2 eq cov'd; **Al 90, Cu 10**	2 eq cov'd **Al 5, Cu 95**	2 cov'd; Cu 100	2 eq cable; Cu 70, Al 30
Banked; Networked; % 3ph	No; No; **0**	Yes; No; **5**	Yes; Yes; **2**	No; No; **0**	Yes; No; **0**
Min. service size; Metal, %	6 eq; Al 95, Cu 5	6 eq; Al 67, ACSR 33	6 eq; ACSR 5, Cu 95	6; Cu 100	6 eq; Al 50, Cu 50
Services, % (W)ire, (C)able, (P)reassem.	**99W, 1P**	100P	99.5W, 0.5C	100W	100P
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	**40F, 60U**	80F, 20I	90F, 5I, 5U	100F	100U
Transformer bank SC Kva	**3,000**	**6,000**	3,750 & 5,000	**3,000** to **7,500**	**2,500**
Subtransmission Kv	26.4	24, 40	23, 34, 69	34.5, 69	34.5
Normal load limit (S)um., (W)int., %	100S, 135W	72S, 75W	. . ., 125W	120S, 120W	132S, 152W
Emerg. load limit, (S)um., (W)int., %	125S, 150W	145S, 150W	. . ., 150W	160S, 160W	161S, 178W
Sq mi. substa.; No. feeders substa.	**4; 3 to 6**	**4; 5 to 6**	. . .; **2**	**3 to 4; 4**	1; 4
Exits % (W)ire, (A)erial, (B)ured, (D)uct	**30W, 70D**	100D	95W, 5D	100W	90B, 10D
VOLTAGE REGULATION					
Substa. tap change; % Fdrs with regulators	Yes; 20	. . .; 0	No; 80	No; **20**	Yes; 0
% Fdrs with pole-mtd (R)egulators;	R 3;	R 5;	R 0;	R 1;	R 0;
(P)ri. capac.; (S)ec. capac.	P 100; S 0	**P 8**; S 0	P 50; S 0	P 100; **S 0**	P 0; S 0
% Primary capacitors—Unswitched,	**80**	None	100	. . .	20
Switch by (T)ime; (V)olt.; (A)mp; (O)ther	**V 20**	T 100	None	. . .	T 80
SERVICE RELIABILITY					
Criterion	. . .	. . .	. . .	. . .	. . .
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	F, R, L	None	F, R, S, L	F, L	F, R, L
Pickup switching; Feeder plan provides	Manual; Ties	Manual; Ties	Manual; . . .	None; . . .	None; Network

South Atlantic Utilities...

Sharp increase in feeder ratings from 3,970 kva average to a predicted 4,850 is the South Atlantic answer to growth at the rate of 12% annually. Primary voltage already has advanced to 23 kv for one company with a second proposing it for the future. Over half the others already use 12.47 or 13.2 kv and the trend is toward 65% in this bracket.

ACSR already has 40% use for primary circuits and little change is indicated for the future. A similar situation applies to secondaries where ACSR and aluminum total 52%. But a swing to 41% for preassembled services from 28% today is expected to boost aluminum to 68% in that area.

From 12 Individual Electric Utility Companies

Rural; 10%; 1	**Rural; 7%; 2**	**Rural; 8 to 12%; 3**	**Rural; 10%; 4**	**Rural; 15%; 5**	**Rur. & Res.; 12%; 6**	**Res. & Rur.; 10%; 7**
12 Ygnd; Joint . . ACSR; . . . . Bare; ACSR 100 H, Platform	12.47 Ygnd; Joint 2 eq ACSR; . . . . Bare; ACSR 90, Cu 10 R, Platform	12.5 Ygnd; Joint **4/0** eq ACSR; **5,000** Not; None Bare; **ACSR 95, Cu 5** D, H, Platform	12.47 Ygnd; No **4** eq ACSR; . . . Not; None Bare; ACSR 90, Al 10 D, R, H	**12 Ygnd;** Joint **2** eq **ASCR; 2,000** Not; None Bare; **Cu 85 ACSR 15** D H	23 Ygnd; Joint 2/0 eq ACSR; 10,000 Not; None Bare; ACSR 98, Cu 2 H	**23** Ygnd; Joint 4/0 eq ACSR; 10,000 Trees, appear; Non-met. Bare; **ACSR 100** H, Platform
5 to 167 (**10**) Conv; 125S, 150W Repl. taf., cut spacing No; No None	5 to 167 (**10**) Conv; 150S, 150W Repl. taf. No; No None	**10** to **50** (**15**) Int. bkr; **125S, 135W** Repl. taf., cut spacing Yes; No None	**3** to 50 (**5**) Int. bkr; 150S, 200W Repl taf., cut spacing **Yes**; No None	**10** to **333** (**15 & 25**) **Int. bkr;** 125S, 150W Repl. taf., cut spacing No; No None	**10** to 167 (**25**) Int. bkr; 175S, 175W Repl. taf. cut spacing Yes; No None	**10** to 100 (**15**) Int. bkr; 150S, 150W Cut spacing Yes; Yes 15 to 150 (75)
. . bare; ACSR 100 No; No; 0 6 eq; Al 100 50W, 50P	2 eq cov'd; ACSR 90, Cu 10 No; No; 0 6 eq; Al 100 100W	2 eq bare; ACSR 90, Cu 10 No; No; 0 **4** eq; Al 90, ACSR 10 100W	1/0 eq bare; **ACSR 100** Yes; No; 1 8 eq; **Al 100** **50W, 50P**	2 Cov'd; Cu 100 Yes; No; **10** 6; Cu 100 **100W**	2 eq bare; ACSR 98, Cu 2 No; No; **5** 6 eq; Al 95, Cu 5 5W, 95P	2 eq bare; **ACSR 100** **Yes;** No; **25** 2 eq; **Al 90, Cu 10** **10W,** 15C, **75P**
100F . . . 22 to 132 ASA ASA 100W	**75F,** 25U 1,500 to 5,000 34.5 100S, 110W ASA **50; 3** **90W, 10B**	100F 3,750 22, 33, **44** 100S, 125W 150S, 175W 500; **3** 100W	100F **1,500** 66 120S, 135W 130S, 140W 130; 2 100W	**85F, 15U** **1,000** to 3,000 22 125S, 150W 150S, 150W 40; 2 100W	100F 15,000 66, **110** ASA ASA **35; 4** 99W, 1D	**75F, 25U** **5,000** **100** 120S, 120W 150S, 150W . . .; **3** **95W, 5B**
Yes; 0 R 50; **P 10;** S 0 None V 100	No; **65** R 50; P 25; S 0	No; **90** R 10; P 10; S 0 **93** V 5, **A 2**	. . ; 75 R 15; P 10; S . . **85** **T 10, V 5**	. . .; **100** **R 5;** **P 50; S 1** **30** **T 50, A 20**	No; 0 R 26; **P 20;** S 0 **75** **T 2, V 12, A 11**	**Yes; 70** **R 25;** **P 90;** S 0 **50** **V 45, A 5**
None F, R, S, L **Automat.**; Ties	. . . F, R, S, L Man.; Ties, network	. . . F, R, S, L Man.; **auto.; Ties**	. . . F, R, S, L Man.; **Ties, network**	. . . F, R, S, L Automat.; Ties	None F, R, S None; Ties	30 min./yr. F, R, S, L Man.; **Ties,** mobile

Distribution for Tomorrow's Loads

12 Ygnd; Joint . . . ACSR; . . . . Bare; ACSR 100 H, Platform	12.47 Ygnd; Joint 2 eq ACSR; . . . . Bare; ACSR 90, Cu 10 R, Platform	12.5 Ygnd; Joint **2/0** eq ACSR; **3,000** Not; None Bare; **ACSR 90, Cu 10** D, H, Platform	12.4 Ygnd; Non-joint **6** eq ACSR; . . . Not; None Bare; . . . D, R, H	**7.2 delta;** Joint **4 Cu; 1,000** Not; None Bare; **Cu 80, ACSR 15** **Cwd 5** D, R, H	23 Ygnd; Joint 2/0 eq ACSR; 10,000 Not; None Bare; ACSR 98, Cu 2 H	**12.5** Ygnd; Joint 4/0 eq ACSR; 7,500 Trees, appear.; Non-met. Bare; **ACSR 90, Cu 10** H, Platform
5 to 167 (**5**) Conv; 125S, 150W Repl. taf., cut spacing No; No None	5 to 167 (**5**) Conv; 150S, 150W Repl. taf. No; No None	**5** to **37½** (**10**) Int. bkr; **135S,** 135W Repl. taf., cut spacing Yes; No None	**1½** to 50 (**3**) Int. bkr; 150S, 200W Repl. taf., cut spacing **No;** No None	**5** to 333 (**10 & 15**) **Conv;** 125S, 150W Repl. taf., cut spacing No; No None	3 to 167 (**15**; Int. bkr; 175S, 175W Cut spacing Yes; No None	**5** to 100 (**10**) Int. bkr; 150S, 150W Cut spacing Yes; Yes 15 to 150 (75)
. . bare; ACSR 100 No; No; 0 6 eq; Al 100 50 W, 50P	2 eq cov'd; ACSR 90, Cu 10 No; No; 0 6 eq; Al 100 100W	**4** eq bare; ACSR 90, Cu 10 No; No; 0 **6** eq; Al 90, ACSR 10 100W	1/0 eq bare; **ACSR 95** Cu 5 Yes; No; 1 8 eq; **Al 50, ACSR 45, Cu 5** **100W**	**4** cov'd; Cu 100 Yes; No; **5** 6; Cu 100 **95W, 5C**	2 eq bare; ACSR 98, Cu 2 No; No; **2** 6 eq; Al 95, Cu 5 5W, 95P	2 eq bare; ACSR 90 Cu 10 **No;** No; **15** **6** eq; **Al 80, Cu 20** **5W, 15C, 80P**
100F . . . 22 to 132 ASA ASA 100W	**65F, 10 I, 25U** 1,500 to 5,000 34.5 100S, 110W ASA **100; 2** **88W, 2B, 10D**	100F 3,750 22, 33, **44** 100S, 110W 150S, 175W 500; **2** 100W	100F **600** 66 120S, 135W 130S, 140W 130; 2 100W	**95F, 5U** **300** to 3,000 22, 125S, 150W 150S, 150W **40; 1** 100W	100F 15,000 66 ASA ASA **50; 4** 99W, 1D	**100F** 2,000 **44** 100S, 100W 125S, 125W . . .; **2** **100W**
Yes; 0 R 50; **P1;** S 0 None V 100	Yes; **50** R 50; P 25; S 0	No; **75** R 10; P 10; S 0 **90** V 5, **A5**	. . .; 75 R 15; P 10; S 0 **95** **T 5**	. . .; **98** **R 1;** **P 35; S 0** **31** **T 40, A 29**	No; 0 R 26; **P 16;** S 0 **84** **V 14, A2**	**No;** 80 **R 10;** **P 75;** S 0 **70** **V 29, A 1**
None F, R, S, L **Manual**; Ties	. . . F, R, S, L Man.; Ties, network	. . . F, R, S, L Manual; **None**	. . . F, R, S, L Manual; **None**	. . . F, R, S, L Automat.; Ties	. . . F, R, S None; Ties	30 min/yr F, R, S, L Man.; Mobile sub.

South Atlantic Utilities, continued . . .

Feeder regulators enjoy their greatest popularity in the Southeast, holding firm at 51% of circuits. Factor in this is reluctance to use tap-changing unit substations. Unit construction today is used for only 12% of substations and little change is predicted. Possible explanation for this marked departure from national trends is ability to get 85% of circuits out overhead, an advantage which replies indicate will largely be maintained with some help from aerial cable. Substation transformers trend toward marked preference for 5,000 kva in the future as many companies move upward from today's 2,000 to 3,750 kva range.

High acceptance of No. 2 equivalent for secondary con-

Future Trends in Distribution are Revealed in These Data

System type; Load growth; Co.	Rur. & Res.; 15%; 8	Rur. & Res.; 14%; 9	Rur. & Res.; 13.5%; 16	Res.; . . .%; 1	Res.; 15%; 11
PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	13.2 Ygnd; Joint	12.5 Ygnd; Joint	12.47 Ygnd; Joint	12 Ygnd; Joint	12.5 Ygnd; Joint
Feeder conductor; Kva rating	4/0 eq ACSR; 5,000	4/0 Cu; 5,000	4/0 eq ACSR; . . .	2/0 eq Al; 7,000	4/0 Cu; 5,000
Cable req'd by; Type preferred	Econ., congest.; Non-met.	Trees, econ.; Lead	. . .; Non-met.	. . .; . . .	Econ.; Non-met.
Lateral conductor type; Metal, %	Bare; ACSR 50, Cu 50	Bare; Cu 100	Bare; ACSR 50, Cu 50	Bare; ACSR 100	Bare; Cu 100
Maint. (D)e-energ., (R)ubber, (H)ot stick	H	D, H, Platform	R, H, Platform	H, Platform	H
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	5 to 500 (25)	5 to Max. (25)	10 to 167 (25)	5 to 50 (15)	10 to 50 (15 & 25)
Preferred type; Load (S)um., (W)int., %	Conv; 125S, 150W	Conv; 175S, 175W	Ld. Ind; 150S, 200W	Conv; 125S, 150S	Conv; 125S, 125W
Overload relieved by	Cut spacing	Cut spacing	Cut spacing	Repl. taf., cut spacing	Cut spacing
Taps req'd for voltage; Trend to 3ph	No; No	Yes; No	Yes; No	No; No	Yes; Yes
Ratings purch 3ph (Most common)	None	None	None	None	None
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	2 eq bare; ACSR 50, Cu 50	2 bare; Cu 100	2 eq bare; ACSR 50, Cu 50	1/0 eq cov'd; Al 100	3 cov'd; Cu 100
Banked; Networked; % 3ph	No; No; 10	No; No; 25	No; Yes; 25	No; No; 0	No; No; 30
Min. service size; Metal, %	6 eq; Al 60, ACSR 35, Cu 5	6 eq; Al 55, Cu 45	6 eq; ACSR 90, Cu 10	4 eq; Al 100	6; . . .
Services, % (W)ire, (C)able, (P)reassem.	5W, 95P	40W, 5C, 55P	10W, 90P	100P	75W, 25P
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	100F	90F, 10I	95F, 10U	90F, 10U	.
Transformer bank SC kva	10,000	10,000	5,000	. . .	. .
Subtransmission kv	. . .	66	66	22 to 66	46, 110
Normal load limit (S)um., (W)int., %	100S, 100W	150S, 150W	125S, 150W	ASA	115S, 115W
Emerg. load limit, (S)um., (W)int., %	125S, 150W	200S, 200W	150S, 200W	ASA	125S, 125W
Sq mi/substa.; No. feeders/substa.	25; 6	25; 6 to 8	16; 3	. . .; . . .	. . .; 2
Exits % (W)ire, (A)erial, (B)uried, (D)uct	50W, 20A, 30D	. . .	75W, 25D	60W, 40D	75W, 25A
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	Yes; 50	Yes; 75	No; . . .	Yes; 0	No; 30
% Fdrs. with pole-mtd. (R)egulators;	R 10;	R 25;	R 0;	. . .;	R 20;
(P)ri. capac.; (S)ec. capac.	P 100; S 100	P 100; S 0	P 100; S 0	. . .; . . .	P 90; S 0
% Primary capacitors—Unswitched;	99	80	70	100	60
Switch by (T)ime; (V)olt; (A)mp; (O)ther	V 1	V 20	T 15; O 15	None	T 40
SERVICE RELIABILITY					
Criterion	None	None	. . .	None	. . .
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds	F, R, S, L	F, R, S, L	F, R, S, L	. . .	F, R, S, L
Pickup switching; Feeder plan provides	Manual; Ties	Man., auto.; Ties, netw.	Man., auto.; Ties, netw.	Automat.; Ties	Manual; Ties

Today's Practices Build Their

PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	13.2 Ygnd; Joint	12.5 Ygnd; Joint	12.47 Ygnd; Joint	12 Ygnd; Joint	12.5 Ygnd; Joint
Feeder conductor; Kva rating	1/0 eq ACSR; 5,000	4/0 Cu; 5,000	4/0 Cu; . . .	2/0 eq Al; 7,000	4/0 Cu; 5,000
Cable req'd by; Type preferred	Econ., congest.; Non-met.	Trees, econ.; Lead	. . .; Non-met.	. . .; . . .	Econ.; Non-met.
Lateral conductor type; Metal, %	Bare; ACSR 10, Cu 90	Bare; Cu 90, ACSR 10	Bare; Cu 80, ACSR 20	Bare; ACSR 100	Bare; Cu 100
Maint. (D)e-energ.; (R)ubber, (H)ot stick	H	D, H, Platform	R, H, Platform	H, Platform	H
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	5 to 500 (15)	5 to Max. (10)	10 to 167 (25)	5 to 50 (15)	10 to 50 (15 & 25)
Preferred type; Load (S)um., (W)int., %	Conv; 125S, 150W	Conv; 175S, 175W	Conv; 150S/150W	Conv; 125S, 150W	Conv; 125S, 125W
Overload relieved by	Cut spacing	Cut spacing	Cut spacing	Repl. taf., cut spacing	Cut spacing
Taps req'd for voltage; Trend to 3ph	No; No	Yes; No	Yes; No	No; No	Yes; No
Ratings purch 3ph (Most common)	None	None	None	None	None
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	2 eq bare; ACSR 50, Cu 50	2 bare; Cu 95, ACSR 5	2 eq bare; Cu 90, ACSR 10	1/0 eq cov'd; Al 100	3 cov'd; Cu 100
Banked; Network; % 3ph	No; No; 5	No; No; 10	No; No; 10	No; No; 0	No; No; 10
Min. service size; Metal, %	6 eq; Al 60, ACSR 35, Cu 5	6 eq; Cu 90, Al 10	6 eq; Cu 91, ACSR 9	6 eq; Al 100	6; Cu 100
Services, % (W)ire, (C)able, (P)reassem.	5W, 95P	85W, C5, P10	90W, 1C, 9P	100P	99W, 1P
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	100F	100F	100F	100F	100F
Transformer bank SC kva	10,000	10,000	3,000	. . .	. . .
Subtransmission kv	. . .	66	66	22 to 66	46, 110
Normal load limit (S)um., (W)int., %	100S, 100W	150S, 150W	125S, 150W	ASA	115S, 115W
Emerg. load limit (S)um., (W)int., %	125S, 150W	200S, 200W	150S, 200W	ASA	125S, 125W
Sq mi/substa.; No. feeders/substa.	50; 3	25; 6 to 8	16; 3	. . .; . . .	. . .; 2
Feeders exits % (W)ire (A)erial, (B)uried, (D)uct	90W, 2A, 8D	. . .	100W	60W, 40D	100W
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	No; 90	Yes; 50	No; 81	Yes; 0	No; 30
% Fdrs. with pole-mtd. (R)egulators;	R 10	R 5;	R 0	. . .	R 10;
(P)ri. capac.; (S)ec. capac.	P 100; S 100	P 80; S 0	P 75; S 0	. . .; . . .	P 90; S 0
% Primary capacitors—Unswitched;	99	95	90	100	100
Switch by (T)ime; (V)olt; (A)mp; (O)ther	V 1	V 5	T 4; V 4; O 2	None	None
SERVICE RELIABILITY					
Criterion	None	None	. . .	None	. . .
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	F, R, S, L	F, R, S, L	F, R, L	. . .	F, R, S, L
Pickup switching, Feeder plan provides	Manual; Ties	Man., auto.; Ties, netw.	Manual; Ties	Manual; Ties	Manual; Ties

ductors appears in its designation by 11 of the 17 utilities for future practices. It reflects abandonment of No. 4 by four companies. Two already bank secondaries, and a third expects to bank in the future.

A sharp increase from 5% to 13% is predicted for three-phase secondaries. Three utilities already use three-phase transformers to feed them and consider that the future trend. Single-phase transformers show a swing from 62% conventional in present practice to 50% internally protected in the future and one utility looks for improved load-indicating units. Little change is foreseen in the range of sizes, but more use of larger transformers is indicated.

From 10 Individual Electric Utility Companies

Res., 11%, 12	Res., 20 to 25%, 3	Res., 10 to 15%, 13	Res., 8%, 14	Res., 8%, 15	Res., 10%, 16	Res., 6 to 20%, 17
12 Ygnd; Joint 4/0 eq ACSR; 7,500 Not; None Bare; ACSR 75, Cu 25	12.5 Ygnd; Joint 4/0 eq ACSR; 6,000 . . . ; . . . Bare; ACSR 95, Cu 5	12.47 Ygnd; Joint 300 MCM Cu; 3,000 . . . ; . . . Bare; Cu 65, ACSR 35	4.8 delta; Joint 2/0 eq ACSR; 1,600 . . . ; . . . Bare; Cu 50, ACSR 50	4.16 Ygnd; Joint 4/0 Cu; 2,100 . . . ; . . . Bare; Cu 100	4.16 Ygnd; Joint 1/0 eq Al; 2,250 Trees, congest.; Non-met. Bare; Al 50, Cu 50	4.16 Ygnd; Joint 350 MCM Cu 2,500 Law, trees; Lead Aer. cable; ACSR 50, Cu 50
H, Platform	D, H	H, Platform	R	R	R	R
5 to 50 (25) Int. bkr; 125S, 140W Repl. taf., cut spacing Yes; No None	15 to 50 (37½) Int. bkr; 125S; 135W Cut spacing Yes; No None	10 to 167 (25) Conv; 150S, 150W Cut spacing No; No 150 to 150 (150)	5 to 167 (25) . . .; 140S, 140W Cut spacing . . .; No None	15 to 50 (37½) Int bkr; 125S, 150W Cut spacing . . .; No . . .	15 to 167 (37½) Conv; 100S, 140W Cut spacing No; No . . .	5 to 167 (25) Int. bkr; 100S, 160W Cut spacing No; Yes 9 to 500 (75)
1 eq preass.; Al 90, Cu 10 Yes; No; . . . 4 eq.; Al 99, Cu 1	2 eq cov'd; ACSR 90, Cu 10 Yes; No; 3 6 eq; Al 100	. . .; Cu 65; ACSR 35 No; No; . . . 8 eq; Cu 65, ACSR 35	2 cov'd; Cu. No; No; 30 8 eq; Cu 70, Al 30	2 cov'd; Cu 100 No; No; 50 6 eq; Cu 99, C 1	2 eq cov'd; Al 50, Cu 50 No; No; 0 4 eq; Al 50, Cu 50	1/0 eq cov'd; ACSR 50 Cu 50 No; No; 10 to 15 8 eq; Al 45, Cu 45, ACSR 10
1W, 99P	100W	100W	70W, 30P	95W, 5C	100W	80W, 10C, 10P
100F 6,000 67 133S, 133W . . . 3; 2 50W, 50D	85F, 15U 7,500 22, 33, 44 100S, 125W 150S, 175W 7; 4 100W	100F 5,000 to 10,000 44 ASA ASA 1 to 4; 3 to 4 100W	40F, 60U 5,000 33 & 44 110S, 130W 130S, 150W 1; 4 98W, 1A, 1D	95F, 5U 1,500 to 5,000 46 100S, 125W 125S, 150W 1; 3 85W, 15D	10F, 90I 5,000 13.8 & 34.5 128S, 153W 149S, 188W 1; 6 10W, 90D	50I, 50U 3,750 to 7,500 13.8 & 33 112S, 137W 134S, 159W 4 to 10; 2 to 20 10W, 5A, 85D
Yes; 95 R10; P95; S 10 35 T 60; O 5	No; 98 R 0; P 10; S 0 93 T 1; A 2; O 4	No; 80 R 5; P 50; S 0 90 V 10	No; 60 R 20; P 100; S . . 75 T 25	No; 65 R 0 P 75; S 0 90 V 10	Yes; 0 R 5; P 33; S 0 50 V 25; A 25	Yes; 10 R 5; P 90; S 0 0 T 60; V 40
None F, R, S, L Manual; Ties	. . . F, R, S L, Man., auto.; Ties	. . . F, R, S Manual; Ties	. . . F, R, S Man.; Spare fdr., netw.	None F, R, S, L Man., auto.; Ties	None F, R Manual; Network	None F, R Man., auto.; Ties

Distribution for Tomorrow's Loads

4 Ygnd; Joint 4/0 Cu; 2,300 Not; None Bare; ACSR 50, Cu 50 R	4.16 Ygnd; Joint 4/0 eq. ACSR; 2,000 . . . ; . . . Bare; ACSR 90, Cu 10 D, R	4.16 Ygnd; Joint 4/0 Cu; 2,500 Not; None Bare; Cu 80, ACSR 20 D, R	4.8 delta; Joint 2/0 Cu; 1,600 . . . ; . . . Bare; Cu 65, ACSR 30, R	4.16 Ygnd; Joint 4/0 Cu; 2,100 . . . ; . . . Bare; Cu 100 R	4.16 Ygnd; Joint 1/0 Cu; 2,250 Not; None Bare; Cu 100 R	4.16 Ygnd; Joint 4/0 Cu cable; 1,800 Law, trees.; Lead Cov'd; Cu 80, ACSR 20 R
10 to 50 (15) Int. bkr; 140S, 140W Repl. taf., cut spacing No; No None	15 to 50 (25) Int. bkr; 135S, 135W Cut spacing Yes; No None	5 to 167 (15) Conv; 150S, 150W Cut spacing No; No 150 to 150 (150)	3 to 167 (25) . . .; 140S, 140W Cut spacing . . .; No None	15 to 37½ (25) Conv; 125S, 150W Repl. taf., cut spacing . . .; No . . .	10 to 167 (25) Conv; 100S, 140W Cut spacing No; No 30 to 45	5 to 167 (15) Int. bkr; 100S, 160W Cut spacing No; Yes 9 to 500 (45)
1 eq preass.; Al 90, Cu 10 No; No; 1 4 eq; Al 99, Cu. 1	4 eq cov'd; ACSR 90, Cu 10 No; No; 0 6 eq; Al 100	3 eq cov'd; Cu 80, ACSR 20 No; No; 0 8 eq; Cu 96, ACSR 4	4 cov'd; Cu . . . No; No; 10 8 eq; Cu 85, Al 15	2 cov'd; Cu 100 No; No; 5 to 10 8; Cu 100	2 cov'd; Cu 100 No; No; 0 4; Cu 100	4 eq cov'd; ACSR 50 Cu 50 No; No; 5 to 10 8 eq; Al 45, Cu 45, ACSR 10
1W, 99P	100W	100W	90W, 10P	98W, 2C	100W	100W
100U 2,000 12 125S, 128W . . . 3; 3 100W	95F, 5U 3,750 11, 13, 22, 33, 44 100S, 125W 150S, 175W 7; 2 100W	100F 2,000 to 5,000 44 ASA ASA 6 to 9; 1 to 2 100W	50F, 50U 5,000 33, 44 110¾, 130W 130S, 150W 1; 4 98W, 1A, 1D	99F, 1U 1,500 to 3,000 13.8 100S, 125W 125S, 150W 4.5 to 2.0; 2 75W, 24D	25F, 75I 5,000 13.8, 34.5 128S, 153W 149S, 188W 2; 6 20W; 80D	65I, 10U 3,750 13.8, 33 112S, 137W 134S, 159W 5 to 20; 4 to 12 10W, 90D
Yes; 95 R10; P 95; S 1 72 T 21; O 7	No; 95 R 0; P 10; S 0 90 T 1; V 7; A 2	No; 80 R 5; P 25; S 0 95 V 5	No; 50 R 20; P 80;; S 0 75 T 25	No; 59 R 0; P 75; S 0 100 None	Yes; 0 R 5; P 33; S 0 93 T 1; V 5; A 1	Yes; 10 R 5; P 90; S 0 100 None
None F Manual; Ties	None F, R, S, L Manual; Ties	None F, R, S, Manual; Ties	. . . F, R, S Man.; Spare fdr, netw.	None F, R, S, L Man., auto.; Ties	None F, R, S, L Manual; Network	None F, R Manual; Ties

Pacific Utilities...

Already 55% committed to 12.47 and 13.2 kv, Pacific utilities foresee little change in distribution voltage or circuit rating. But the average number of outgoing feeders is expected to increase fractionally to about 4 matched by growth from 6,000 to 7,500 kva for the substation banks.

Field assembly remains the preferred type of substation construction, but is expected to decline 10% to 57% in the future as units gain acceptance. Little departure is expected from today's 62% use of open wire to get away, but ACSR and aluminum are expected to reach 43% and 14%, respectively, from today's total of under 25% for distribution primaries.

Future Trends in Distribution are Revealed in These Data

System type; Load growth; Co.	Rur.; 8%; 1	Rur.; 7%; 2	Rur. & Res.; 10 to 15%; 3	Rur. & Res.; 10%; 4	Rur. & Res.; 10%; 5
PRIMARY CIRCUITS					
Kv. ph to ph; Joint with tel.	12.5 **Ygnd; Joint**	12 Ygnd; Joint	13.2 Ygnd; Joint	12.5 Ygnd; Joint	12.47 Ygnd; Joint
Feeder conductor; Kva rating	2/0 eq **ACSR**; 4,000	**250 MCM** eq A1; 4,000 to 6,000	1 eq **ACSR**; 4,000	1/0 Cu; 6,000	4/0 eq **A1**; 6,000
Cable req'd by; Type preferred	. . . ; . . .	**Trees; Non-met.**	Econ.; . . .	. . . ; . . .	Reliability; . . .
Lateral conductor type; Metal, %	Bare; **ACSR 50, Cu 50**	Bare; **ACSR 45, Al 30, Cu 25**	Bare; **ACSR 100**	Bare; **Cu 75, ACSR 20, Cwd 5**	Bare; **A1 or ACSR 95, Cu 5**
Maint. (D)e-energ., (R)ubber, (H)ot stick	D, H	D, H	H	D, H	H
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	**10** to 167 (**10**)	**10** to 100 (10)	15 to 100 (37½ & **50**)	**15** to 50 (25)	**10** to 167; (25)
Preferred type; Load (S)um., (W)int., %	Conv; 125S, 150W	Conv; **110S, 135W**	Int. bkr; 125S, 175W	Int. bkr, . . ., **110W**	Int. bkr; . . ., 150W
Overload relieved by	Repl. tsf.	Repl. tsf.	Cut spacing	Repl. tsf., cut spacing	Repl. tsf., cut spacing
Taps req'd for voltage; Trend to 3ph	Seldom; No	Yes; No	Yes; No	No; Yes	No; No
Ratings purch 3ph (Most common)	. . .	None	None	**15 to 45** (. . .)	. . .
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	4 eq bare; **ACSR 50, Cu 50**	. . . eq bare; **ACSR 50-Cu 50**	2 eq bare; **ACSR 100**	2 eq bare; **Cu 60, Al 40**	2 eq cov'd; Al or ACSR 90, Cu 10
Banked; Networked; % 3ph	**Yes**; No; **10**	No; No; 40	No; No; 5	**Yes**; No, . . .	No; No; 0
Min. service size; Metal, %	6 eq; **Al 85, ACSR 15**	8 eq; **Al 80; Cu 50**	6 eq; **Al 100**	6 eq; **Al 50, Cu 50**	4 eq; A1 100
Services, % (W)ire, (C)able, (P)reassem.	**60W, 40P**	**50W, 50P**	**100P**	**50W, 50P**	100P
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	**100F**	**100F**	**25F, 75U**	**80F, 20U**	25F, 75U
Transformer bank SC kva	**10,000**	**5,000** to 20,000	**15,000 & 24,000**	**8,000**	**7,500**
Subtransmission kv	55	69, 110	115	69	57
Normal load limit (S)um., (W)int., %	100S; 125W	**105S, 130W**	115S; 135W	122S, 122W	. . ., 150W
Emerg. load limit (S)um., (W)int., %	**125S, 150W**	**130S, 160W**	. . ., . . .	155S, 155W	ASA, ASA
Sq mi/substa.; No. feeders/substa.	**16; 4**	50; 4	**15**; 2 to 6	**4; 6**	**9; 8**
Exits, % (W)ire, (A)erial, (B)uried, (D)uct	100W	95W, 5D	100W	50W, 50D	100D
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with reg'rs	**Yes; 0**	No; 0	No; **75**	Yes; **5**	Yes; 0
% Fdrs. with pole-mtd. (R)egulators;	**R 15;**	R 10;	R 10;	R 0;	R . . . ;
(P)ri. capac.; (S)ec. capac.	**P 100;** S . . .	**P 90;** S 0	**P 15,** S 0	P100; S . . .	**P 100;** S 0
% Primary capacitors—Unswitched;	50;	**90;**	50;	**35;**	100;
Switch by (T)ime; (V)olt; (A)mp; (O)ther	V 50	**T 1, V 9**	T 50	**T 25; V 30; O 10**	**A Possible**
SERVICE RELIABILITY					
Criterion	None	None	None	. . .	**Study**
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	F, R, S	F, R, **S**, L	F, R, S	F, R, S, L	F, R, S, L
Pickup switching; Feeder plan provides	Manual; Ties; **network**	**Manual**; Ties	Manual; None	Man., auto.; Ties	Automat ; Ties, network

Today's Practices Build Their

PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	12.5 Y isol'd; Joint	12 Ygnd; Joint	13.2 Ygnd; Joint	12.5 Ygnd; Joint	12.47 Ygnd; Joint
Feeder conductor; Kva rating	2/0 **Cu**; 4,000	4/0 eq Al; 4,000 to 6,000	**2 Cu**; 4,000	1/0 Cu; 6,000	4/0 eq **ACSR**; 6,000
Cable req'd by; Type preferred	. . . ; . . .	Not; None	Econ.; None	. . . ; . . .	Reliability; Non-met.
Lateral conductor type; Metal, %	Bare; **Cu 80, ACSR 20**	Bare; **Cu 50, ACSR 40, Al 10**	Bare; **Cu 100**	Bare; **Cu 98, Cwd 2**	Bare; **ACSR 85, Cu 15**
Maint. (D)e-energ.; (R)ubber, (H)ot stick	D, H	D, H	H	D, H	H
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	5 to 167 (7½)	3 to 100 (10)	15 to 100 (**25** & 37½)	5 to 50 (25)	5 to 167 (**10** & 25)
Preferred type; Load (S)um., (W)int., %	Conv; 125S, 150W	Conv; **100S, 150W**	Int. bkr; 125S, 175W	Int bkr; . . ., **150W**	Int. bkr; . . ., **150W**
Overload relieved by	Repl. tsf.	Repl. tsf.	Cut spacing	Repl. tsf., cut spacing	Repl. tsf., **cut spacing**
Taps req'd for voltage; Trend to 3ph	Seldom; No	Yes; No	Yes; No	No; Yes	No; No
Ratings purch 3ph (Most common	. . .	None	None	. . .	
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	4 eq bare; **Cu 80, ACSR 20**	. . . eq bare; **90 Cu, 10 ACSR**	2 bare; **Cu 100**	4 bare; Cu 100	2 eq cov'd; ACSR 50, Al 40, Cu 10
Banked; Network; % 3ph	**No**; No; **5**	No; No; 40	No; No; 5	No; No; . . .	No; No; 0
Min. service size; Metal, %	8 eq.; Cu 80, Al 20	8 eq.; **Cu 100**	6 eq.; **Al 75, Cu 25**	**8**; Cu 100	6 eq.; Al 100
Services, % (W)ire, (C)able, (P)reassem.	**100W**	**100W**	**25W, 75P**	94W, 1C, 5P	100P
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	**98F, 2I**	**97F, 3U**	**50F, 50U**	**60F, 40U**	25F, 75U
Transformer bank SC kva	**5,000**	2,000 to 20,000	3,750 & 12,000	**6,000**	**6,000**
Subtransmission kv	55	69, 110	115	69	57
Normal load limit (S)um., (W)int., %	100S, 125W	100S, 100W	115S, 135W	122S, 122W	. . . S, 150W
Emerg. load limit (S)um., (W)int., %	**150S, 175W**	. . . , . . .	. . . , . . .	155S, 155W	ASA
Sq mi/substa.; No. feeders/substa.	**50; 3**	50; 4	**15 to 30**; 2 to 6	**9; 3**	**36; 2**
Exits, % (W)ire, (A)erial, (B)uried, (D)uct	100W	95W, 5D	100W	50W 50D	100D
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with reg'rs	**No; 2**	No; 0	No; **90**	Yes; **3**	Yes; 0
% Fdrs. with pole-mtd. (R)egulators;	**R 10;**	R 10;	R 10;	R 0;	R 0;
(P)ri. capac.; (S)ec. capac.	**P 70;** S . . .	**P 75;** S 0	**P 10;** S 0	P 100, S . . .	**P 90;** S 0
% Primary capacitors—Unswitched;	50	**97**	50	**42**	100
Switch by (T)ime; (V)olt; (A)mp; (O)ther	V 50	T 1; **V 2**	T 50	**T 36; V 22**	None
SERVICE RELIABILITY					
Criterion	None	None	None	. . .	**None**
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	F, R, S	F, R, L	F, R, S	F, R, S, L	F, R, S, L
Pickup switching; Feeder plan provides	Manual; Ties	**None**; Ties	Manual; None	Man., auto.; Ties	Man., auto.; Ties netw

Secondaries show a greater gain for aluminum and ACSR from 9 and 7% today to 24 and 37%. An important factor in this is plans of one utility to use preassembled aluminum for secondaries as well as service drops. Aluminum for services trends toward 69%, and half of the users of No. 8 propose to increase to No. 6 equivalent.

Despite low isokeraunic levels in much of the Pacific area, future trends show 3 to 2 preference for internally protected distribution transformers, reversing today's use of conventionals. Banking is practiced or proposed by over half the utilities, and secondary sizes show a pronounced trend toward No. 2 equivalent.

From 11 Individual Electric Utility Companies

Rur. & Res.: 10%; 6	Res.: 16%; 2	Res.: 10%; 7	Res.: 10%; 8	Res.: 10%; 9	Res.: 7%; 10	Res.: 8%; 11
12 Ygnd; Joint 2/0 eq. ACSR; 2,500 . . .; . . . Bare; ACSR 80, Cu 20	12 Ygnd; Joint 250 MCM eq. Al; 4,000 Trees; Non-met. Bare; Al 50, Cu 50	12 Ygnd; Joint 1 eq. ACSR; 5,000 . . .; . . . Bare; ACSR 80, Cu 20	4.8 delta; Joint 4/0 Cu; 2,500 . . .; . . . Bare; CU 100	4.16 Ygnd; Joint 2/0 eq. Al; 1,500 . . .; Non-met. Cov'd; Al 100	4.16 Ygnd; Joint 4/0 Cu; 3,000 . . .; . . . Cov'd; Cu 100	4 Ygnd; Joint 4/0 Cu; 2,500 . . .; . . . Bare; ACSR 50, Cu 50
H	D, H	H	R	R	R	D, R
10 to 75 (25) Int-bkr., . . .; 200W Cut spacing Yes; No . . .	15 to 75 (37½) Int. bkr.; 110S, 135W Cut spacing No;	5 to 167 (15) Int. bkr.; 150S, 150W Cut spacing Yes; Possible . . .	15 to 75 (25) Int. bkr.; 110S, 140W . . . No; No . . .	25 to 167 (50) Conv.; . . ., 125W Repl. tsf., cut spacing Yes; No 30 to 30 (30)	25 to 167 (37½) Conv.; 125S, 125W Repl. tsf. No; No . . .	15 to 167 (25) Conv.; 125S, 150W Cut spacing Seldom; No . . .
2/0 eq cov'd; Cu 95, ACSR 5 Yes; No; 10 4 eq.; Al. 50, ACSR 25, Cu 25 25W, 75P	2 eq preass.; Al 100 Yes; No; . . . 8 eq; Al 100 100P	4 eq cov'd; Al 80, Cu 20 Yes; No; 0 8 eq; Al 80, Cu 20 100P	2 eq cov'd; Al 90, Cu 10 Yes; No; 0 8 eq; Al 90, Cu 10 50W, 50P	4 eq cov'd; ACSR 100 Yes; No; 10 6 eq; Al 60, ACSR 30, Cu 10 10W, 90P	2 aer. cable; Cu 100 Yes; No; 0 6; Cu 100 100P	2 bare, cov'd; ACSR 80, Cu 50 Yes; No; 10 6 eq; Al 67, ACSR 33 50W, 50P
100F 500 to 2,500 66 120S, 120W 160S, 160W . . .; 3 95W, 5D	90F, 1I, 9U 10,000 to 40,000 69, 110 105S, 130W 130S, 160W 16; 12 16W, 84D	10F, 90U 7,500 16 100S, 120W 120S, 130W 3; 8 83W, 3A, 14D	100F 5,000 to 20,000 34.5 100S, 100W 120S, 120W 3; 15 100D	100U 3,000 52.5 ASA 150S, 150W 1; 4 100W	100U 5,000 26 100S, 130W 150S, 175W 1:4 100D	90F, 10U 7,500 55 100S, 125W 125S, 150W 1; 4 95W, 5D
No; . . . R 25; P 5, S Possible	No; 5 R0; P 25; S 0 80 V 20	Yes; . . . R10; P 50; S 0 90 V 10	Yes; 100 R 0; P 0; S 0 50 A 50	Yes; 0 R 15; P 100; S 10 50 V 25, A 25	Yes; 0 R 0; P 10; S 0 None T 100	No; 0 R 10; P 50; S 0 50 V 50
Possible F, R, S, L Automat., Ties, network	None F, R, L Man., auto.; Ties	. . . R, S, L Automat.; Ties	None R, S Man., auto.; Ties	None F, R, S, L Manual; Ties, network	Study R Manual; Ties, network	None R Manual; Ties, network

Distribution for Tomorrow's Loads

12 Ygnd; Joint 2/0 Cu; 1,200 . . .; . . . Bare; ACSR 80, Cu 20	12 Ygnd; Joint 4/0 Cu; 4,000 Trees; Non-met. Bare; Cu 100	4 Ygnd; Joint 2/0 Cu; 2,250 . . .; . . . Bare; ACSR 60, Cu 40	4.8 delta; Joint 4/0 Cu; 2,500 . . .; . . . Bare; Cu 100	4.16 Ygnd; Joint 2/0 Cu; 1,500 . . .; . . . Cov'd; Cu 100	4.16 Ygnd; Joint 4/0 Cu; 3,000 . . .; . . . Cov'd; Cu 100	4 Ygnd; Joint 2/0 Cu; 1,800 . . .; . . . Cov'd; Cu 99, ACSR 1
R	D, H	R	R	R	R	D, R
5 to 75 (25) Conv; . . .; 200W Cut spacing Yes; No . . .	10 to 50 (25) Conv; 100S, 150W Cut spacing No; No None	5 to 100 (15) Int. bkr; 150S, 150W Cut spacing No; No . . .	10 to 50 (15) Conv;110S, 140W . . . No; No . . .	25 to 167 (25) Conv; . . ., 125W Repl. tsf., cut spacing Yes; No 30 to 30 (30)	25 to 167 (25) Conv; 150S, 150W Repl. tsf. No; No . . .	5 to 167 (15) Conv; 125S, 150W Repl. tsf.; cut spacing Seldom; No . . .
4 eq cov'd; Cu 95, ACSR 5 Yes; No; 10 6 eq; Al 50, ACSR 25, Cu 25 25W, 75P	2 eq cov'd; Cu 99, Al1 Yes; No; 0 8 eq; Cu 99, Al 1 99W, 1P	4 eq cov'd; Al 60, Cu 40 Yes; No; 0 8 eq; Al 60, Cu 40 100W	2 eq cov'd; Cu 98, Al 2 Yes; No; 0 8 eq; Cu 98; Al 2 100W	4 cov'd; Cu 100 Yes; No; 5 6 eq; Cu 90, Al 7, ACSR 3 90W, 10P	2 cov'd; Cu 100 Yes; No; 0 6; Cu 100 100W	4 bare, cov'd; Cu 99, ACSR 1 Yes; No; 5 8 eq; Cu 80, Al 20 99W, 1P
100F 333 to 2,500 66 120S, 120W 160S, 160W . . .; 3 95W, 5D	94F, 1I, 5U 5,000 to 30,000 69, 110 100S, 100W . . .; . . . 16; 10 20W, 80D	10F, 90U 7,500 12, 16 100S, 120W 120S, 130W 3; 8 84W, 1A, 15D	100F 5,000 to 20,000 34.5 100S, 100W 120S; 120W 7; 15 100D	100F 3,000 52.5 150S, 150W 150S; 200W 1; 4 100W	5F, 95U 6,000 26 100S, 130W 150S, 175W 1; 4 100D	95F, 3I, 2U 3,000 12.5, 55 100S, 125W 150S, 175W 4; 1 100W
No; 5 R 10; P 10; S 0	No; 20 R 0; P 20; S 0 100 None	No; 100 R 0; P 50; S 0 90 V 10	No; 100 R 0; P 0; S 0 None None	Yes; 10 R15; P100; S 0 100 None	Yes; 0 R 0; P 2 to 3; S 0 None T 100	No; 10 R 0; P 50; S 0 50 V 50
None F, R, S, L Manual; Ties, network	None F, R, L Manual; Ties	. . . R, S, L Automat.; Ties	None R, S Manual; Ties	None F, R, S, L Manual; Ties	None R Manual; Ties, network	None R Manual; Ties

Middle Atlantic Utilities...

Noteworthy among Middle Atlantic utilities is their comprehensive treatment of voltage. Primary capacitors, reported already in use on 65% of feeders, are expected to advance beyond 81%. With various forms of automatic switching moving up toward 50%, these capacitors contribute to voltage regulation. Use of feeder regulators is expected to drop from 47% to 33% of feeders, largely offset by a growing preference for tap-changing substation transformers.

Size preference in substation banks remains around 5,000 kva, but 7,500 and 10,000 kva are expected to gain, offset by declines at 3,750 kva and below 2,000. Unit construc-

Future Trends in Distribution are Revealed in These Data

System type ; Load growth; Co.	Rural; 8%; 1	Rural; 12%; 2	Rural; 10 to 12%; 3	Rural; 10%; 4	Rural; 10%; 5
PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	13.2 Ygnd; Joint	12.45 Ygnd; Joint	12.47 Ygnd; Joint	12.4 Ygnd;	12 Ygnd; Joint
Feeder conductor; Kva rating	1/0 eq ACSR; 2,500	4/0 eq Al; 3,000	2/0 eq ACSR; 5,000	1 eq ACSR; 1,800	1/0 Cu; 3,000
Cable req'd by; Type preferred	Trees; Non-met.	. . .; . . .	Trees; Non-met.	Trees, econ.; Non-met.	Appear; Non-met
Lateral conductor type; Metal, %	Bare; ACSR 100	Bare; ACSR 70, Al 20, Cu 10	Bare; ACSR 50, Cu 25, Cwd 25	Bare; ACSR 90, Cu 10	Bare; Cu 60, ACSR 38, Cwd 2
Maint. (D)e-energ., (R)ubber, (H)ot stick	H	D, H	D, H	D, H	R, H
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	10 to 25 (10)	10 to 50 (10)	10 to 167 (15)	5 to 80 (15)	10 to 100 (15)
Preferred type; Load (S)um., (W)int., %	Int. bkr; 125S, 150W	Int. bkr; 100S, 140W	Int. bkr; 125S, 150W	Conv; 125S, 150W	Int. bkr, 140S, 140W
Overload relieved by	Cut spacing	Repl. taf.	Repl. taf.	Repl. taf., cut spacing	Repl. taf.
Taps req'd for voltage; Trend to 3ph	No; No	. . .; No	Yes; No	No; No	No; No
Ratings purch 3ph (Most common)	. . .	. . .	None	None	None
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	1/0 eq cov'd; ACSR 100	4 eq cov'd; ACSR 90, Cu 10	1 eq bare; Cu 65, ACSR 35	1 eq bare; ACSR 90, Cu 10	4 eq bare; Cu 85, ACSR 15
Banked; Networked; % 3ph	No; No; Small	No; No; . . .	No; No; 5	No; No; . . .	No; No; 20
Min. service size; Metal, %	4 eq; Al 100	6 eq; Al 100	4 eq; Cu 65, Al 35	6 eq; Al 90, Cu 10	2 eq; Cu 90, Al 10
Services, % (W)ire, (C)able, (P)reass.	100 P	95 W, 5P	75W, 25P	10W, 90P	90W, 7P
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	50F, 50U	100F	50F, 50U	70F, 30U	25F, 75U
Transformer bank SC kva	2,000 to 3,750	5,000	5,000	1,500 to 3,000	1,000 to 7,500
Subtransmission kv	66	34.5	23,34.5	34.5, 69	22 to 66
Normal load limit (S)um., (W)int., %	110S, 125W	ASA	100S, 100W	100S, 100W	ASA
Emerg. load limit (S)um., (W)int., %	125S, 150W	ASA	110S, 125W	120S, 150W	. . .
Sq mi/substa.; No. feeders/substa.	100; 2	80; 3	30; 4	. . .; 2	200; 4
Exits % (W)ire, (A)erial, (B)uried, (D)uct	. . .	100W	100W	90W, 10D	90W, 10D
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	Yes; 100	No; 0	No; 0	Yes; 80	No; 10
% Fdrs. with pole-mtd. (R)egulators; (P)ri. capac.; (S)ec. capac.	R 50; P 50; S . .	R 40; P 100; S . .	R 0; P 100; S Few	R 80; P 100; S 0	R 75; P 100; S 0
% Primary capacitors—Unswitched; Switch by (T)ime; (V)olt; (A)mp; (O)ther	65 V 5; A 10	80 A 10, O 10	None O 100	50 V 50	50 V 50
SERVICE RELIABILITY					
Criterion	60 min/yr	. . .	None	. . .	Study
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	F, R, L	F, R, L	F, R	F, R, L	F, R, L
Pickup switching; Feeder plan provides	Man., auto.; Ties, netw	None; Ties, network	. . .; Ties	Man., auto.; Ties	Man., auto., Ties

Today's Practices Build Their

PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	4.16 Ygnd; Joint	8.3 Ygnd; Joint	4.16 Ygnd; Joint	4.8 delta; Non-joint	12 Ygnd; Joint
Feeder conductor; Kva rating	1/0 eq ACSR; 1,400	2 Cu; 500	2/0 Cu; 1,500	2 eq ACSR; 1,500	4 Cu; 1,800
Cable req'd by; Type preferred	Trees; Non-met.	. . .; . . .	Trees; Non-met.	. . . .	Appear.; Non-met.
Lateral conductor type; Metal, %	Bare; Cu 70, ACSR 30	Bare; ACSR 55, Cwd 25, Al 10, Cu 10	Bare; Cu 65, Cwd 25, ACSR 10	Bare; ACSR 70, Cu 30	Bare; Cu 75, ACSR 22, Cwd 3
Maint. (D)e-energ.; (R)ubber, (H)ot stick	R	R, H	D, H	R, H	R, H
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	5 to 25 (5)	5 to 25 (5)	5 to 100 (10)	5 to 37½ (5)	5 to 75 (10)
Preferred type; Load (S)um., (W)int., %	Int. bkr; 125S, 150W	Int. bkr; 100S, 140W	Int. bkr; 125S, 150W	Conv; 125S, 150W	Int. bkr; 140S, 140W
Overload relieved by	Cut spacing	Repl. taf.	Repl. taf.	Repl. taf., cut spacing	Repl. taf.
Taps req'd for voltage; Trend to 3ph	No; No	. . .; No	Yes; No	No; No	No; No
Ratings purch 3ph (Most common)	None	. . .	None	None	None
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	1/0 cov'd; Cu 100	4 eq bare; ACSR 90, Cu 10	1 eq bare; Cu 95, ACSR 5	4 eq bare; ACSR 70, Cu 30	4 eq bare; Cu 95, ACSR 5
Banked; Network; % 3ph	No; No; 0	No; No; . . .	No; No; 5	No; No; 0	No; No; 5
Min. service size; Metal, %	6 eq; Cu 90, Al 10	6 eq; Al 100	6 eq; Cu 100	6 eq; Al 90, Cu 10	6 eq; Cu 98, Al 2
Services, % (W)ire, (C)able, (P)reass.	90W, 10P	95W, 5P	100W	10W, 90P	98W, 2C
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	50F, 50U	100F	100F	70F, 30U	40F, 60U
Transformer bank SC kva	750 to 1,500	3,000	3,750	1,500 to 3,000	300 to 5,000
Subtransmission kv	13.8, 66	34.5	23, 34.5	13.2, 34.5	22 to 66
Normal load limit (S)um., (W)int., %	110S, 125W	ASA	100S, 100W	100S, 100W	ASA
Emerg. load limit (S)um., (W)int., %	125S, 150W	ASA	110S, 125W	120S, 150W	. . .
Sq mi/substa.; No. feeders/substa.	50; 2	80; 3	15; 4	. . .; 2	200; 2
Exits % (W)ire, (A)erial, (B)uried, (D)uct	95W, 2A, 3D	100W	100W	90W, 10D	90W, 10D
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	Yes; 50	No; 25	No; 0	Yes; 80	No; 0
% Fdrs. with pole-mtd. (R)egulators; (P)ri. capac.; (S)ec. capac.	R 50; P45; S . . .	R 30; P100; S . . .	R 0; P50; 50	R 70; P80; 80	R 50; P85; 80
% Primary capacitors—Unswitched; Switch by (T)ime; (V)olt; (A)mp; (O)ther	90 V 10	95 A 5	2 O 98	90 V 10	80 V 20
SERVICE RELIABILITY					
Criterion	70 min/yr	. . .	None	None	None
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	F, R, L	F, R, L	F, R	F, R, L	F, R, L
Pickup switching; Feeder plan provides	Manual; Ties, network	Manual; Ties	Manual; Ties	Manual; None	Manual; Ties, mobile

tion is expected to advance to 55% from today's 42, almost matched by increasing use of duct cable for exits. But aerial cable is predicted to reach 3.6% as an economical compromise between duct cable and open wire.

Number of feeders per substation is expected to change but little from the present 2 to 4 range. But their voltage reflects the national trend toward higher volage. Replies indicate 30% at 12.47 and 13.2 kv, practically double the present use, and 17% at 8.3 which is little used today. With this will come an increased average circuit rating of 3,370 kva, up from today's 2,540.

Primary conductors are predicted to swing to 50% ACSR

From 11 Individual Electric Utility Companies

Rural; 10%; 6	Rural; 12 to 15%; 7	Rur. & Res., 7 to 8%, 8	Rur. & Res., 10 to 15%, 9	Rur. & Res., 3 to 20%, 10	Res., 12%, 11
8.32 Ygnd; Joint 2/0 Cu; **3,000** **Veil.,** . . . Bare; . . .	**4.6 delta;** Joint **4/0** Cu; **3,000** **Trees;** . . . Cov'd; Cu 100	12.47 Ygnd; **Joint** 2/0 eq **Al; 6,000** Trees, congest.; Non-met. Bare; ACSR 95 ,Cu 5	**8.3** Ygnd; Joint 2/0 eq Al; **1,500** Trees, **congest.; Lead** Bare; ACSR 50, **Al 40, Cu 10**	. . . .	13.2 Ygnd; Joint 1/0 eq **Al; 7,500** Trees; econ.; Non-met. Bare; .
H	R, H	H	H	R	H
10 to 250 **(25)** **Int.** bkr; 130S, 150W Cut spacing, repl. taf. No; No . . .	**10** to **167 (10 & 15)** Int. bkr; 100S, 100W Repl. taf., cut spacing No; **Yes** . . .	**10** to 500 **(15 & 25)** Conv; . . ., 120W Repl. taf., cut spacing Yes; No **45** to **300 (112½)**	**10** to 100 **(15)** **Int. bkr Ld. ind.**; . . ., 150W Repl. taf., cut spacing No; No . . .	3 to 167 (15 to 75)	**25** to **100 (25)** Int. bkr; 160S, 160W Cut spacing No; **Yes** . . .
4 bare; . . . No; No; 10 **4** eq; **Cu 60; Al 40** 100W	4 cov'd; Cu 100 Yes; No; 0.5 6; Cu 100 **75W, 25C**	2 eq bare; **Al 45, ACSR 40, Cu 15** **No;** No; 5 **4** eq; **Al 63, ACSR 32, Cu 5** **5W, 95P**	2eq cov'd; ACSR 55, **Al 35, Cu 10** No; No; **15** 6 eq; Al 100 100W	. . . .	2eq cov'd; A 180, Cu 20 Yes; Yes; **25** 6 eq; **Al 80, Cu 20** **100P**
100U **7,500** 34.5 125S, 130W 140S, 150W **3**; 2 25W, 75D	90F, 10I . . . 33, 66 100S, 100W . . . . . .; 2 to 6 **50W, 50D**	100F 1,500 to 10,000 66 125S, 150W 160S, 200W . . .; 2 **99W, 1D**	**60F, 40U** 1,500 to 5,000 23, 34.5 115S, 135W 150S, 190W . . .; **3** **65W, 20A, 15D**	. . . .	**50F, 50U** **10,000** **33, 66** 110S, 138W 200S, 200W **4; 8** **100D**
Yes; 10 R . . .; **P 100;** S	Yes; 60 R 40; P 100; S . . . **50** **T 50**	No; 0 R 0; P 100; S 5 None T 10; **V 40; O 50**	**Yes; 35** **R 25;** **P 100;** S 0 **90** **V 10**	. . . .	Yes; **25** **R 0;** P 10; S . . . **80** **T 30; V 2.5; A 2.5; O 5**
. . . F, R, **S, L** . . .; Ties, **network**	. . . F, R, S, L Manual; Ties	None F, R, S, L **Automat.;** Ties	None F, R, S, L Manual; Ties, mobile	60 min/yr F, R, S, L . . .; Ties, network	F, R, S, L Manual; Ties, network

Distribution for Tomorrow's Loads

4.8 delta; Joint 2/0 Cu; **2,000** **Not;** None Bare; Cu 80, ACSR 20	**2.4** delta; Joint **4/0** Cu; **1,300** . . .; . . . Cov'd; Cu 100	12.47 Ygnd; Joint 2/0 **Cu; 5,000** Trees, congest; **Lead,** non-met. Bare; ACSR 95, Cu 5	**4.16** Ygnd; Joint 2/0 eq. Al; **1,000** Trees; Lead Cov'd; ACSR 50, **Al 35, Cu 15**	4.16 Ygnd; Joint 4/0 Cu; 2,500 . . .; Lead Bare; Cu 99	13.2 Ygnd; Joint 1/0 **Cu; 5,000** Trees, econ.; **Lead,** non-met Bare; Cu 100
R	R, H	D, H	R	R	H
5 to 250 **(15)** Int. bkr.; 130S, 150W Cut spacing, repl. taf. No; No . . .	**5** to **150 (5)** Int. bkr.; 100S, 100W Repl. taf., cut spacing No;	**5** to 500 **(10)** Conv.; . . ., 120W Repl. taf., cut spacing Yes; No **30** to **150 (75)**	**3** to 100 **(10)** **Conv.;** . . ., 150W Repl. taf., cut spacing No; No . . .	3 to 167 (15 to 75) Int. bkr.; 120S, 140W Cut spacing, repl. taf. No; No 75 to 500 (150 to 300)	**10** to **167 (15)** Int. bkr.; 160S, 160W Cut spacing, **repl. taf.** No; **No** . . .
4 eq bare; Cu 90, ACSR 10 No; No; 10 **4** eq; **Cu 98, Al 2** 100W	4 cov'd; Cu 100 Yes; No; 0.5 6; Cu 100 **100W**	2eq cov'd; **Cu 99** **Yes;** No; 5 **6** eq; **Al 90, Cu 8** **98W, 2P**	2eq cov'd; ACSR 55, **Al 30, Cu 15** No; No; **10** 6 eq; Al 100 100W	2eq bare; A Few; No; . . . 6 eq; Cu 90, Al 10 99W	2 eq cov'd; A 180 ,Cu 20 Yes; Yes; **5** 6 eq; **Al 75, Cu 25** **20W, 20C, 60P**
100U **3,000** 34.5 125S, 130W 140S, 150W **4**; 2 25W, 75D	90F, 10I . . . 33, 66 100S, 100W . . . . . .; 2 to 6 **90W, 10D**	100F 1,500 to 10,000 66 125S, 150W 160S, 200W . . .; 2 **100W**	**70F, 30U** 1,500 to 5,000 23, 34.5 115S, 135W 150S, 190W . . .; 2 **80W, 20D**	100U 1,000 to 3,750 23 116S, 139W 140S, 154W 1 to 10; 1 to 2 30W, 70D	**75F, 25U** **5,000** **23, 33** **120S,** 138W 200S, 200W **6; 3** **25W, 75D**
Yes; 10 R 90; **P 80;** S 0 100 None	Yes; 60 R 40; P 100; S . . . **90** **T 10**	No; 0 R 0; P 100; S 0 None T 10; **V 90**	**No; 45** **R 20;** **P 90;** S 0 **100** **None**	Yes; 90 R 20; P 10; S . 100 None	Yes; **85** **R 10;** P 10; S . . . **94** **T 14; V 0.5; A 0.5; O 1**
None F, R **None; Ties**	. . . F, R, S, L Manual; Ties	None F, R, S, L **Manual;** Ties	None F, R, S, L Manual; Ties, mobile	60 min/yr F, R, S, L Manual; Ties, network	None F, R, S, L Manual; Ties, network

and 5% aluminum from a combined 28%. Similar trends are shown for secondaries, while services move from 45% to 64, reflecting a 26% gain for preassembled services.

Data show a 3 to 2 preference today for self-protecting distribution transformers, and interest in load indicators threatens future inroads on the conventional type.

Even for rural use, 10 kva is designed by 8 of 10 companies as the minimum for future purchases. Most of these companies buy some 5 kva transformers today. Less uniformity appears in the minimum for residential use, but the most common sizes run consistently between 25 and 50 kva with growing use of large transformers.

Future Trends in Distribution are Revealed in These Data

System type; Load growth; Co.	Res.; 8 to 15%; 2	Res.; 10 %; 4	Res.; 7%; 1	Res.; 7%; 3
PRIMARY CIRCUITS				
Kv ph to ph; Joint with tel.	8.32 Ygnd; Joint	4.8 delta; Joint	4.16 Ygnd; Joint	4.16 Ygnd; Joint
Feeder conductor; Kva rating	300MCM eq Al; 4,500	4/0 eq ACSR; 2,000	4/0 eq ACSR; 2,500	4/0 Cu; 2,400
Cable req'd by; Type preferred	Trees, congest.; Non-met.	Trees, appear.; Non-met.	Trees; Non-met.	Congest.; Non-met.
Lateral conductor type; Metal, %	. . .; Cu 100	Bare; ACSR 50, Cu 50	Bare; ACSR 100	Cov'd; Cu 90, ACSR 10
Maint. (D)e-energ., (R)ubber, (H)ot stick	D, H	R	R	R
DISTRIBUTION TRANSFORMERS				
Ratings purch 1ph (Most common)	10 to 75 (50)	25 to 100 (50)	15 to 50 (25)	25 to 167 (50)
Preferred type; Load (S)um., (W)int., %	Int. bkr; 100S, 140W	Conv; 125S, 150W	Int. bkr; 125S, 150W	Int. bkr; 125S, 150W
Overload relieved by	. . .	Cut spacing, repl. taf.	Cut spacing	Repl. taf.
Taps req'd for voltage; Trend to 3ph	. . .; Yes	No; No	No; No	Yes; No
Ratings purch 3ph (Most common)	None	None	. . .	None
SECONDARIES & SERVICE DROPS				
Preferred sec. conductor; Metal, %	2/0 eq cov'd; Cu 75, Al 25	1 eq cov'd; Al 60, Cu 40	1/0 eq cov'd; ACSR 100	2/0 cov'd; Cu 100
Banked; Networked; % 3ph	Yes; No; 0	No; No; 5	Yes; Yes; 10 to 15	Yes; Yes; 15
Min. service size; Metal, %	4 eq; Al 100	6 eq; Al 90, Cu 10	6 eq; ACSR 100	4; Cu 100
Services, % (W)ire, (C)able, (P)reassem.	75W, 25P	10W, 90P	100P	75W, 25P
DISTRIBUTION SUBSTATIONS				
% (F)ield assem., (I)ndoor, (U)nit	95F, 5U	40F, 60U	100U	5F, 5I, 90U
Transformer bank SC kva	7,500	1,500 to 3,750	2,000 to 5,000	5,000
Subtransmission kv	34.5, 46	13.2, 34.5	13.8, 66	. . .
Normal load limit (S)um., (W)int., %	ASA	100S, 100W	110S, 125W	100S, 100W
Emerg. load limit (S)um., (W)int., %	ASA	120S, 150W	125S, 150W	100S, 133W
Sq mi/substa.; No. feeders/substa.	2.2; 6	. . .; 4	5; 4	2; 4
Exits, % (W)ire, (A)erial, (B)uried, (D)uct	60W, 40D	20W, 80D	25W, 75D	20W, 10A, 70D
VOLTAGE REGULATION				
Substa. tap change; % Fdrs. with regulators	Yes; 0	Yes; 20	Yes; 25	No; 0
% Fdrs. with pole-mtd. (R)egulators;	R . . .;	R 15;	R 70;	R 0;
(P)ri. capac.; (S)ec. capac.	P . . .; S . .	P 90; S . .	P 100; S . . .	P 100; S Few
% Primary capacitors—Unswitched;	80	50	85	None
Switch by (T)ime; (V)olt; (A)mp; (O)ther	. . .	V 50	T 5; A 10	O 100
SERVICE RELIABILITY				
Criterion	None	None	60 min/yr	None
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	None	F, R, S, L	F, R, L	F, R
Pickup switching; Feeder plan provides	Automat.; . .	Manual; Ties, network	Man., auto.; Ties, network	. . .; Ties

Today's Practices Build Their

PRIMARY CIRCUITS				
Kv ph to ph; Joint with tel.	4.8 delta; Joint	4.8 delta; Joint	4.16 Ygnd; Joint	4.16 Ygnd; Joint
Feeder conductor; Kva rating	. . .; . . .	4/0 Cu; 2,000	4/0 Cu; 1,400	2/0 Cu; 1,500
Cable req'd by; Type preferred	. . .; . . .	. . .; . . .	Trees; Non-met.	Trees; Non-met.
Lateral conductor type; Metal, %	. . .; . . .	Bare; Cu 90, Al 10	Bare; Cu 80, ACSR 20	Cov'd; Cu 100
Maint. (D)e-energ.; (R)ubber, (H)ot stick	. . .	R	R	R
DISTRIBUTION TRANSFORMERS				
Ratings purch 1ph (Most common)	10 to 75 (25)	15 to 100 (25)	15 to 50 (25)	10 to 167 (25)
Preferred type; Load (S)um., (W)int., %	Int. bkr; 100S, 140W	Conv; 125S, 150W	Int. bkr; 125S, 150W	Int. bkr; 125S, 150W
Overload relieved by	. . .	Cut spacing, repl. taf.	Cut spacing	Repl. taf.
Taps req'd for voltage; Trend to 3ph	. . .; Yes	No; No	No; No	Yes; No
Ratings purch 3ph (Most common)	None	None	. . .	None
SECONDARIES & SERVICE DROPS				
Preferred sec. conductor; Metal, %	2/0 eq cov'd; Cu 98, Al 2	2 eq cov'd; Cu 90, ACSR 10	1/0 eq cov'd; Cu 90, ACSR 10	1 cov'd; Cu 100
Banked; Network; % 3ph	Yes; No; 0	No; No; 5	Yes; No; 5 to 10	Yes; No; 15
Min. service size; Metal, %	6 eq; Al 100	6 eq; Al 90, Cu 10	6 eq; Cu 90, ACSR 10	6; Cu 100
Services, % (W)ire, (C)able, (P)reassem.	75W, 25P	10W, 90P	90W, 10P	100W
DISTRIBUTION SUBSTATIONS				
% (F)ield assem., (I)ndoor, (U)nit	100F	60F, 40U	25F, 75U	90F, 5I, 5U
Transformer bank SC kva	5,000	1,500 to 3,750	2,000 to 3,750	3,750
Subtransmission kv	23, 34.5, 46	13.2, 34.5	13.8, 66	. . .
Normal load limit (S)um., (W)int., %	ASA	100S, 100W	110S, 125W	100S, 100W
Emerg. load limit (S)um., (W)int., %	ASA	120S, 150W	125S, 150W	100S, 133W
Sq mi/substa.; No. feeders/substa.	4.5; 3	. . .; 4	10; 3	4; 4
Exits, % (W)ire, (A)erial, (B)uried, (D)uct	90W, 10D	20W, 80D	25W, 75D	50W, 10A, 40D
VOLTAGE REGULATION				
Substa. tap change; % Fdrs. with regulators	No; 80	Yes; 20	Yes; 50	No; 0
% Fdrs. with pole-mtd. (R)egulators;	R . . .;	R 15;	R 80;	R 0;
(P)ri. capac.; (S)ec. capac.	P . . .; S . .	P 85; S . .	P 90; S . .	P 80; S 0
% Primary capacitors—Unswitched;	98	90	90	2
Switch by (T)ime; (V)olt; (A)mp; (O)ther	. . .	V 10	V 10	O 98
SERVICE RELIABILITY				
Criterion	None	None	70 min/yr	None
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	None	F, R, L	F, R	F, R
Pickup switching; Feeder plan provides	Manual; . .	Manual; Ties, network	Manual; Ties, network	Manual; None

The trend toward larger transformers is matched by a predicted sharp increase in No. 1 equivalent and larger secondaries. Secondary banking is already used by nine of the 15 utilities in this geographic area, but one indicates a trend away from it. Several also indicate the possibility of converting banks to networks. And a substantial number of companies favor 3-phase transformers to serve the increasing 3-phase load.

Engineering for service reliability reaches a high in this area with four utilities reporting present design criteria and three others indicating plans to study reliability for future guidance.

From 10 Individual Electric Utility Companies

Res.; 12%; 5	Res. 12 to 15%; 7	Res.; 3 to 10% ;12	Res.; 8%; 13	Res.; 6 to 7%; 14	Res.; 11 to 12%; 15
4.16 Ygnd; Joint 4/0 Cu; 3,500 Appear., congest.; Non-met. Bare, cov'd; **Cu 92, Al 5, ACSR 3** R	4.16 Ygnd; Joint 2/0 Cu; 1,500 Trees, congest.; Non-met. Cov'd; Cu 100 R, H	4.16 Ygnd; Joint 2/0 Cu; 3,000 Trees, econ.; Lead, non-met. Cov'd; . . . R	4.16 Ygnd; Joint . . . Cu; **2,250** Trees; **Shielded** Bare; ACSR 100 R	4.16 Ygnd; Joint 250MCM eq Al; 2,000 Trees, congest., Lead Cov'd; Cu 100 R	4.16 Ygnd; Joint 250MCM eq Al; 2,500 Trees; Non-met. Bare; **Al 50, Cu 50** R
15 to 167 (**25**) Int. bkr; 140S, 140W Cut spacing No; No . . .	**10** to 200 (**10**) Int. bkr; 150S, 150W Repl. tsf., cut spacing No; **Yes** **45** to **45** (**45**)	**10** to 100 (25) Conv, **Int. bkr**; 135S, 150W Repl. tsf., cut spacing No; Yes 15 to 75 (45)	**25** to 100 (**50**) **Ld. ind.**; 150S, 165W Cut spacing, **repl. tsf.** No; Yes **75** to **112½** (**75**)	10 to 200 (**25**) Conv; 145S, 160W Repl. tsf., cut spacing No; Yes **30** to 75 (**45**)	5 to 167 (25) Int. bkr; **110S, 110W** Repl. tsf., cut spacing No; Yes **45** to **150** (75 & 112½)
1/0 eq cov'd; **Cu 90, Al 10** Yes; No; **35** **2** eq; **Cu 90, Al 10** **90W, 3C, 7P**	2 cov'd; Cu 100 **Yes**; No; **10** **4**; Cu 100 100W	2/0 cov'd; **Al** . . . No; No; **40** 6 eq; **Cu 60, Al 40** **4W, 36C, 60P**	**2/0 eq bare; Al 75, Cu 25** Yes; Yes; 1 **4** eq; **Al 60, Cu 40** **15W, 10C, 75P**	**1** cov'd; Cu 100 No; Yes; **2** 6 eq; Al 100 100P	**1** cov'd; Cu 100 Yes; . . **20** 6 eq; Al 90, Cu 10 7W, 3C, 90P
18F, 2I, 80U 1,000 to **7,500** 22, 33, **66** ASA . . . **15**; **4** **50W, 10A,** 40D	**50F, 50I** 3,000 to 5,000 33 100S, 125W 150S, 150W **25** to **30**; 8 100D	**100U** **5,000** 13.8, 33 115S, 135W 148S, 168W **2**; **4** 100D	25I, 75U **2,500** **13.8**, 33 **100S, 120W** **150S, 170W** **3**; 10 to 12 **10B, 90D**	**50F, 50U** 9,000 26 110S, 135W 160S, 180W **8**; 7 1W, 5A, 94D	**25F, 75U** 34.5 100S, 125W 125S, 150W . . . ; 2 to **4** **58W, 15A, 30D**
No; **10** **R 40**; **P 90**; S 0 **90** **V 10**	No; 100 R 20; P 100; S 0 **75** **T 20; A5**	Yes; **20** **R 20**; P 50; S 0 **75** **T 18; V 7**	Yes; **40** R 20; **P 100**; S 0 **25** **T 15; V 60**	No; 95 R 5; **P 75**; S 20 **45** **T 30; V 5; O 20**	**Yes; 35** **R 75**; **P 95**; S . . . **50** **V 50**
Study F, R, L Man., **auto.**; Ties, mobile	. . . F, R, S, L Manual; Ties, **network**	. . . F, **R**, S, L None; Ties; network	**40 min/yr** F, L Manual; Ties	**30 min/yr** L Man., auto.; Spare fdr., ties	**Study** F, R, L Manual; Ties

Distribution for Tomorrow's Loads

4.16 Ygnd; Joint 4/0 Cu; 3,500 Appear., congest.; Non-met. Bare, cov'd; **Cu 95, ACSR 5** R	4.16 Ygnd; Joint 2/0 Cu; 1,500 Trees, congest.; Non-met. Cov'd; Cu 100 R	4.16 Ygnd; Joint 2/0 Cu; 3,000 Trees, econ.; Lead, non-met. Cov'd; Cu 100 R	4.16 Ygnd; Joint . . . Cu; **1,500** Trees; **Lead, self-sup.** Bare; ACSR 100 R	4.16 Ygnd; Joint 250MCM eq Al; 2,000 Trees, congest.; Lead Cov'd; Cu 100 R	4.16 Ygnd; Joint 250MCM eq Al; 2,500 Trees; **Lead**, non-met. Bare; **Cu 96, Al 3, Cwd 1** R
5 to 167 (**15**) Int. bkr; 140S, 140W Cut spacing No; No . . .	**5** to 200 (**5**) Int. bkr; 150S, 150W Repl. tsf., cut spacing No; **No** **None**	**5** to 100 (25) Conv; 135S, 150W Repl. tsf., cut spacing No; Yes 15 to 75 (45)	**15** to 100 (**25**) **Conv**; 150S, 165W Cut spacing No; Yes **30** to **75** (**45**)	10 to 200 (**15**) Conv; 145S, 160W Repl. tsf., cut spacing No; Yes **15** to 75 (**30**)	5 to 167 (**15** & 25) Int. bkr; **140S, 140W** Repl. tsf.; cut spacing No; Yes **45** to **112½** (75 & 112½)
4 cov'd; **Cu 100** Yes; No; **10** **6** eq; **Cu 98, Al 2** **98W, 2C**	2 cov'd; Cu 100 **No**; No; **5** to **10** **6**; Cu 100 100W	2 cov'd; **Cu 100** No; No; **10** 6 eq; **Cu 95, Al 5** **5W, 90C, 5P**	**2 eq cov'd; Cu 99, Al 1** Yes; Yes; 1 **4** eq; **Cu 99, Al 1** **50W, 5C, 45P**	**4** cov'd; Cu 100 No; Yes; **1** 6 eq; Al 100 100P	**4** cov'd; Cu 100 Yes; No; **10** 6 eq; Al 90, Cu 10 7W, 3C, 90P
20F, 80U 1,000 to **5,000** 22, 33 ASA . . . **25**; **3** **60W,** 40D	**75F, 25I** 3,000 to 5,000 33 100S, 125W 150S, 150W **30** to **40**; 8 100D	**5F, 40I, 55U** **3,000 to 7,500** 13.8, 33 115S, 133W 148S, 168W **3.9**; **4** 100D	25I, 75U **1,500** 33 **110S, 130W** **170S, 190W** **6**; 10 to 12 **10W, 10A, 30B, 50D**	**60F, 40U** **6,000,** 9,000 26 110S, 135W 160S, 180W **11**; 7 1W, 5A, 94D	**59F, 1I, 40U** 5,000 34.5 100S, 125W 125S, 150W . . . ; 2 to 4 **75W, 5A, 20D**
No; **0** **R 20**; **P 60**; S 0 **95** **V 5**	No; 100 R 20; P 100; S 0 **90** **A 10**	Yes; **35** **R 10**; P 50; S 0 **97** **T 2**	Yes; **50** R 20; **P 50**; S 0 **100** **None**	No; 95 R 5 **P 70**; S 0 **53** **T 16; V 1; O 30**	**No; 80** **R 5**; **P 90**; S 0 **100** **None**
None F, R, L Manual; Ties, mobile	None F, R, S, L Manual; Ties	50 min/yr F, S, L None; Ties, network	**None** F, L Manual; Ties	**32 min/yr** L Man., auto.; Spare fdr., ties	**None** F, R, L Manual; Ties

New England Utilities...

Primary voltage trends upward in New England, also, despite the trees which have long impeded the change. The trend reported for four utilities is to 12.5 or 13.2 kv and another to 8.3 where today's practices are consistently below 5 kv. Conductors will drop toward 76% copper, compared with 85% today.

Distribution transformers show important trends in New England. Present practice leans somewhat toward self-protecting types, but load indicating types are expected to achieve substantial use. Here, too, is the greatest interest in 3-phase transformers; already used to some extent by half the utilities, 70% see a 3-phase trend for the future.

Future Trends in Distribution are Revealed in These Data

System type; Load growth' Co.	Rural; 6 to 25%; 1	Rur. & Res.; 10%; 2	Rur. & Res.; 10 to 15%; 3	Rur. & Res.; 8.7%; 4	Rur. & Res.; 12%; 5
PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	13.8 . . .; . . .	13.8 Ygnd; Joint	12.47 Ygnd; Joint	8.32 . . .; Joint	4.16 Ygnd; Joint
Feeder conductor; Kva rating	. . .; . . .	4/0 Cu; 5,000	2 Cu; . . .	2/0 Cu; 2,780	2/0 Cu; 1,700
Cable req'd by; Type preferred	. . .; . . .	Trees; . . .	Pole space; Lead in duct	Trees, econ.; Non-met.	Pole space; Non-met.
Lateral conductor type; Metal, %	. . .; Al 50, Cu 50	Bare; Cu 100	Bare; Cu 65, Al 15, ACSR 10, Cwd 10	Bare, cov'd; Cu 99, Al 1	Cov'd; Cu 100
Maint. (D)e-energ., (R)ubber, (H)ot stick	. . .	. . .	H	R	R
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	. . .	10 to 50 (25)	10 to 100 (10 & 25)	10 to 100 (. . .)	15 to 50 (25)
Preferred type; Load (S)um., (W)int., %	Int. bkr, Id. ind.; . . .	Ld. ind.; 150S, 170W	Int. bkr; . . .	Int. bkr; 150S, 150W	Conv; 140S, 175W
Overload relieved by	Repl. tsf., cut spacing	Cut spacing	Repl. tsf.	Repl. tsf.	Repl. tsf., cut spacing
Taps req'd for voltage; Trend to 3ph	No; . . .	No; Yes	. . .; No	No; Yes	No; Yes
Ratings purch 3ph (Most common)	. . .	9 to 112½ (30)	Few	Few	. . . (15)
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	2 eq cov'd; Al 50, Cu 50	4 cov'd; Cu 100	4 eq cov'd; Al 100	2 eq cov'd; Cu 99, Al 1	2 eq cov'd; ACSR 50 Cu 50
Banked; Networked; % 3ph	Yes; No; Few	Yes; No; Few	Yes; No; 0	Yes; No; Few	No; No; Few
Min. service size; Metal, %	6; . . .	6 eq; Al 90, Cu 10	6; Cu 90	6 eq; Cu 95, Al 5	6 eq; Al 100
Services, % (W)ire, (C)able, (P)reassem.	20W, 80P	100P	80W, 20C	90W, 10C	100P
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	100F	100F	100F	10F, 90U	100I
Transformer bank SC kva	2,000 to 15,000	5,000	5,000	2,000 to 3,750	5,000
Subtransmission kv	. . .	. . .	33	13.8	13.8
Normal load limit (S)um., (W)int., %	. . .	120S, 162W	100S, 135W	. . .S, . . .W	. . .S, 160W
Emerg. load limit (S)um., (W)int., %	. . .	120S, 162W	. . .	. . .S, 175W	. . .S, 160W
Sq mi/substa.; No. feeders/substa.	. . .; . . .	. . .; 3	. . .; 2	. . .; 2 to 4	. . .; 3 to 4
Exits, % (W)ire, (A)erial, (B)uried, (D)uct	90W, 10D	90W, 10D	80W, 20D	100D	100D
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	No; 100	Yes; 0	Yes; 20	Yes; 0	. . .; 0
% Fdrs. with pole-mtd. (R)egulators; (P)ri. capac.; (S)ec. capac.	R 25; P 100; S 0	R 80; P 100; S 5	R 2; P 5; S 0	R 5 to 10; P 33; S . . .	R 50; P 0; S 0
% Primary capacitors—Unswitched; Switch by (T)ime; (V)olt; (A)mp; (O)ther	25 T 25; V 25; A 25	33 T 33; V 34	70 V 15; A 15	. . . . .	None None
SERVICE RELIABILITY					
Criterion	None	None	None	None	. . .
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	F, R, S	F, R, S, L	F, R, S, L	F, R	F, R
Pickup switching; Feeder plan provides	Man., auto; Ties	Man., auto; Ties	Manual; Ties, netw.	Manual; Ties	Manual; Ties

Today's Practices Build Their

PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	4.16 Ygnd; Joint	4.8 delta; Joint	4.16 Ygnd; Joint	4.16 Ygnd; Joint	4.16 Ygnd; Joint
Feeder conductor; Kva rating	4/0 Cu; . . .	4/0 Cu; 2,000	4/0 Cu; . . .	2/0 Cu; 1,800	2/0 Cu; 1,700
Cable req'd by; Type preferred	. . .; . . .	Not; None	Pole space; Lead in duct	Trees, econ.; Non-met.	Trees; Non-met.
Lateral conductor type; Metal, %	. . .; Al 50, Cu 50	Bare; Cu 95, Cwd 4, ACSR 1	Cov'd; Cu 75, Cwd 20, ACSR 4, Al 1	Bare, cov'd; Cu 99, Al 1	Cov'd; Cu 95, ACSR 5
Maint. (D)e-energ.; (R)ubber, (H)ot stick	R	R	R	R	R
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	3 to 25 (10)	5 to 50 (10 & 15)	5 to 100 (5 & 25)	5 to 100 (25)	15 to 50 (25)
Preferred type; Load (S)um., (W)int., %	Int. bkr; 100S, 125W	Int. bkr; 150S, 170W	Int. bkr; . . .	Int. bkr; 150S, 150W	Conv; . . ., 175W
Overload relieved by	Repl. tsf., cut spacing	Cut spacing	Repl. tsf.	Repl. tsf.	Repl. tsf., cut spacing
Taps req'd for voltage; Trend to 3ph	No; No	No; No	. . .; No	No; Yes	No; No
Ratings purch 3ph (Most common)	None	9 to 75 (30)	Few	None	None
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	2 eq cov'd; Al 50, Cu 50	4 cov'd; Cu 100	4 cov'd; Cu 100	2 eq cov'd; Cu 99, Al 1	2 eq cov'd; Cu 95, ACSR 5
Banked; Network; % 3ph	No; No; 0	No; No; Few	Yes; No; . . .	Yes; No; Few	No; No; 0
Min. service size; Metal, %	6; . . .	6 eq; Al 90, Cu 10	6; Cu 90	6 eq; Cu 95, Al 5	6 eq; Al 100
Services, % (W)ire, (C)able, (P)reassem.	20W, 80P	10W, 90P	80W, 10C	90W, 10C	100P
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	100F	90F, 10U	25F, 75U	10F, 90U	100I
Transformer bank SC kva	2,000 to 15,000	5,000	2,500	2,000 to 3,750	3,750
Subtransmission kv	. . .	. . .	33	13.8	13.8
Normal load limit (S)um., (W)int., %	100S, 120W	120S, 175W	100S, 125W	. . .S, 125W	. . .S, 160W
Emerg. load limit (S)um., (W)int., %	. . .	120S, 175W	. . .	. . .S, 175W	. . .S, 160W
Sq mi/substa.; No. feeders/substa.	. . .; . . .	. . .; 1 to 4	. . .; 2	. . .; 2 to 4	. . .; 2 to 3
Exits, % (W)ire, (A)erial, (B)uried, (D)uct	90W, 10D	95W, 5D	80W, 20D	100D	100D
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	No; 100	Yes; 0	Yes; 20	Yes; 0	. . .; 0
% Fdrs. with pole-mtd. (R)egulators; (P)ri. capac.; (S)ec. capac.	R 33; P 90; S 0	R 80; P 10; S 0	R 5; P 5; S 0	R 5 to 10; P 33; S 0	R 25; P 0; S 0
% Primary capacitors—Unswitched; Switch by (T)ime; (V)olt; (A)mp; (O)ther	50 T 16; V 17; A 17	100 None	70 V 15; A 15	100 None	100 None
SERVICE RELIABILITY					
Criterion	None	None	None	None	None
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	F, S	F, R, L	F, R, S, L	F, R, S	F
Pickup switching; Feeder plan provides	Man., auto; Ties	Manual; Ties	Manual; Ties, netw.	Manual; Ties	Manual; Ties

Copper retains preference in secondary conductors but is predicted to drop materially from its 96% position. Covering continues to be specified by all utilities for their secondaries.

Sizes already seem standardized in the No. 2 to No. 4 range and little change is anticipated. But six of the 10 utilities indicate expectations of banking distribution secondaries in the future.

New England reports the highest use of indoor substations. But unit designs show a sharp trend up to 49% in the future from today's 36%. They report also 65% use of duct cable for station exits, trending toward 71%.

From 10 Individual Electric Utility Companies

Rur. & Res.; 12%; 6	Res.; 7½%; 7	Res.; 4 to 5%; 8	Res.; 10%; 9	Res.; 6 to 8% 10	Res.; 10 to 11%; 1
4.16 Ygnd; Joint 4/0 . . .; 1,200 Trees; Lead, non-met. Cov'd; . . . R	12.47 Ygnd; Joint 1/0 Cu; 3,000 Trees, econ.; Lead Bare; Cu 85, Cwd 8, ACSR 6, Al 1 H	4.8 delta; Joint 300 MCM Cu; 1,500 . . .; Lead Bare; Cu 98, Cwd 1 R	4.16 Ygnd; Joint 1/0 eq Al; 2,160 Econ.; . . . Cov'd; ACSR 80, Cu 9, Cwd 1 R	4.16 Ygnd; Joint 400 MCM Cu cable; . . . Trees; Lead Cov'd; Cu 100 H	2.4 delta; Joint 350 MCM eq ACSR; 1,000 Trees; Lead Cov'd; Al 100 R
5 to 37½ (15) Conv; 150 S, 150W Cut spacing No;	5 to 50 (25) Int. bkr; . . ., 150W Repl. tsf., cut spacing No; Yes 45 to 75 (75)	10 to 50 (37½ & 50) Conv; 150S, 150W Repl. tsf., cut spacing . . .; No . . .	25 to 167 (37½) Int. bkr; 120S, 120W Repl. tsf., cut spacing No; Yes . . .	5 to 37½ (37½) Ld. ind.; . . ., 150W Repl. tsf., cut spacing No; Yes . . .	10 to 75 (50) Ld. ind.; . . ., 125W Repl. tsf., cut spacing . . .; Yes . . .
1/0; Cu 100 No; No; . . . 6 eq; ACSR 100 20W, 80P	3 cov'd; Cu 100 No; No; 0 6; Cu 100 100P	2 cov'd; Cu 98 Yes; No; 0 4; Cu 99 99W, 1P	2 eq cov'd, Al 100 Yes; Yes; 20 6 eq; Al 100 . . .	2 cov'd; Cu 100 No; No; 0 2; Cu 100 20W, 80C	4/0 eq cov'd; Al 100 No; No; Few 3 eq; Al 98, Cu 2 100P
100U 2,000 to 3,000 13.8 110S, 125W 200S, 200W . . .; 2 to 6 100D	90F, 10I 5,000 to 10,000 . . . 100S, 125W . . . . . .; 1 to 3 . . .	100U 3,000 22 125S, 125W . . . 10; 4 to 6 20W, 20A, 60D	5,000 13.8 110S, 140W ASA . . .; 8 5B, 95D	100U . . . 150S, 150W . . . . . .; 14 100D	100U 2,000 to 10,000 . . . .; . . . 100D
Yes; 50 R 50; P 75; S 0 100 None	Yes; 50 R 10; P Few; S 0 98 T 0.5; A 1; O 0.5	Yes; 0 R 3; P 60; S 0	Yes; 0 R . . .; P . . .; S 0 90 T 10	No; 100 R 0; P Few; S 0	Yes; 75 R Few; P 90; S Few . . . . . .
None R, S, L Manual; Ties	None F, R, S, L Manual; Ties	20 min/yr F, R, S, L Manual; Ties	None F, L Manual; Ties	Nine None Manual; Ties	None F, S, L Man., auto.; Ties

Distribution for Tomorrow's Loads

2.4 delta; Joint 4/0 Cu; 1,200 Trees; Lead, non-met. Cov'd; Cu 90, ACSR 9, Al 1 R	4.16 Ygnd; Joint 4/0 Cu; 1,750 Trees, econ.; Lead Bare, cov'd; Cu 85, Cwd 8, ACSR 6, Al 1 R	4.8 delta; Joint 300 MCM Cu; 1,500 . . .; Lead Bare, cov'd; Cu 98, Cwd 1 R	4.16 Ygnd; Joint 1/0 Cu; 2,160 Econ.; . . . Cov'd; Cu 98, Cwd 1, ACSR 1 R	2.4 delta; Joint 400 MCM Cu cable; . . Trees; Lead Cov'd; Cu 100 R	2.4 delta; Joint 350 MCM Cu; 1,000 Trees; Lead Cov'd; Al 100 R
1½ to 75 (15) Conv; 150S, 150W Cut spacing Yes; No 5 to 10 (. . .)	5 to 50 (15 & 25) Int. bkr; . . ., 150W Repl. tsf., cut spacing No; Yes None	5 to 37½ (25) Conv; 150S, 150W Repl. tsf., cut spacing . . .; No . . .	15 to 167 (25) Int. Bkr; 120S, 120W Repl. tsf., cut spacing No; Yes 45 to 300 (112½)	5 to 37½ (25) Ld. ind.; . . ., 150W Repl. tsf., cut spacing No; Yes 30 to 45 (. . .)	5 to 75 (25 & 37½) Conv.; . . ., 125W Repl. tsf., cut spacing . . .; No None
1/0 . . .; Cu 100 No; No; 0 6 eq; ACSR 100 80W, 20P	3 cov'd; Cu 100 No; No; 0 6; Cu 100 100P	2 cov'd; Cu 98 Yes; No; 0 6; Cu 99 99W, 1P	2 cov'd; Cu 100 Yes; No; 10 6; Cu 100 . . .	2 cov'd; Cu 100 No; No; 0 2; Cu 100 50W, 50C	1/0 cov'd; Cu 100 No; No; 0 6 eq; Al 98, Cu 2 100P
100F 2,000 to 3,000 13.8 110S, 125W 200S, 200W . . .; 2 to 6 100D	90F, 10I 3,000 to 10,000 . . . 100S, 120W . . . . . .; 2 to 6 50W, 50A	100U 3,000 11, 22 125S, 125W ASA 10; 2 to 4 10W, 10A, 80D	. . . 5,000 13.8 110S, 140W ASA . . .; 4 to 5 5B, 95D	. . . . 150S, 150W . . . . . .; 12 100D	66F 2,000 to 10,000 13.2 110S, 120W 10W, 90D
No; 10 R 30; P 20; S 0 100 None	No; 90 R 5; P Few; S 0 98 T 0.5; A1; 0 0.5	Yes; 50 R 3; P 60; S 0 100 None	Yes; . . R 30; P 20; S 0 100 None	No; 100 R 0 P 0; S 0 None None	Yes; 5 R Few; P 80; S 0 75 T 8; V 9; A 8
None F, R, S, L Manual; Ties	None F, R, S, L Manual; Ties	30 min/yr F, R, S, L Manual; Ties	None F, L Manual; Ties	None None Manual; Ties	None F, S, L Manual; Ties

West South Central Utilities . . .

Load growth reported to average over 15% annually for rural and residential areas implies that practices reported and anticipated by these 9 utilities reflects the exigencies of extremely rapid growth. Notable is the complete acceptance of 12.47 and 13.2 kv; the last utility indicating plans to convert 2.4 delta to 13.2 for future needs. These feeders carry high ratings trending upward to an average of 4,800 kva from 4,220 today.

Extremely large substations will supply 10 or more of these feeders from banks with self-cooled ratings of 25,000 to 30,000 kva, up from 7,500 to 10,000 today. But smaller stations of 2 or 3 feeders on 2,500 and 3,750 kva will be

Future Trends in Distribution are Revealed in These Data

System type; Load growth; Co.	Rural; 9%; 1	Rural; 11%; 2	Rural; 12%; 3	Rural; 17%; 4	Rur. & Res., 10%; 5
PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	**13.2 Ygnd;** Joint	12.47 Ygnd; Joint	12.47 Ygnd; Joint	12.47 Ygnd; Joint	13.2 Ygnd; Joint
Feeder conductor; Kva rating	4/0 Cu; 1,000	**2/0** eq ACSR; **5,000**	1/0 eq ACSR; 3,000	**2/0** eq ACSR; **2,500**	2/0 eq **ACSR;** 4,000
Cable req'd by; Type preferred	**Trees;** Non-met.	Not; None	Not; None	Not; None	Econ.; Lead
Lateral conductor type; Metal, %	Bare; **Al 50, Cu 50**	Bare; ACSR 100	Bare; ACSR 100	Bare; ACSR 95, Cu5	Bare; **ACSR 60, Cu 40**
Maint. (D)e-energ., (R)ubber, (H)ot stick	R, H, Platform	D, H	D, H	D, H	H, Platform
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	3 to 37½ (5)	**10** to **37½ (10)**	5 to **100 (10)**	5 to 250 (10)	**10** to 167 (**25**)
Preferred type; Load (S)um., (W)int., %	Int. bkr, conv; 100S, 110W	Int. bkr; 150S, . . .W	Conv; 140S, . . .W	Conv; 150S, . . .W	Conv; 140S, . . .W
Overload relieved by	Repl. tsf.	Repl. tsf.	Repl. tsf.	Repl. tsf.	Repl. tsf., cut spacing
Taps req'd for voltage; Trend to 3ph	Yes; Yes	Yes; No	No; No	Yes; No	No; No
Ratings purch 3ph (Most common)	**15** to **150** (45)	None	None	None	15 to 150 (112½)
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	2 eq bare; Al 50, Cu 50	2 eq bare; ACSR 100	6 eq bare; ACSR 100	6 eq bare; ACSR 95, Cu 5	2 eq bare; ACSR 60, Cu 40
Banked; Networked; % 3ph	No; No; 5	No; No; 0	No; No; 0	No; No; 1	No; No; **10**
Min. service size; Metal, %	**6** eq; **Al 50, Cu 50**	**6** eq; **Al 90, Cu 10**	6 eq; **Al 50, ACSR 50**	**6** eq **Al 50, Cu 50**	6 eq; **Cu 50, Al 37, ACSR 13**
Services, % (W)ire, (C)able, (P)reassem.	**75W, 25P**	**50W, 50P**	**25W, 75P**	100P	**30W,** 30C, **40P**
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	**75F, 25U**	100F	100F	100F	**80F, 20U**
Transformer bank SC kva	2,500	1,000	500 to 2,500	3,750	3,750
Subtransmission kv	. . .	66	66	66	69
Normal load limit (S)um., (W)int., %	100S, 150W	110S, . . .W	125S, . . .W	100S, . . .W	100S, . . .W
Emerg. load limit (S)um., (W)int., %	110S, 125W	125S, 150W	150S, . . .	116S, . . .W	130S, . . .W
Sq mi/substa.; No. feeders/substa.	1; 2	100; 2	**50; 3**	**30; 4**	**12; 3**
Exits % (W)ire, (A)erial, (B)uried, (D)uct	100W	100W	100W	100W	**60W,** 5A, **35D**
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	. . .; 95	No; 0	No; 0	. . .; 0	No; **30**
% Fdrs. with pole-mtd (R)egulators; (P)ri. capac.; (S)ec. capac.	R 10; P 50; S . . .	R 20; P 100; S 0	R 10; **P 75;** S 0	**R 5;** P 100; S 0	**R 15; P 70; S 10**
% Primary capacitors—Unswitched; Switch by (T)ime; (V)olt; (A)mp; (O)ther	50 V 50	**50 T 40; V 5; A 5**	40 T 60	None **T 80; V 10; O 10**	50 **V 30; A 20**
SERVICE RELIABILITY					
Criterion	None	**90 min./yr**	. . .	. . .	. . .
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	R, S, L	F, R, L	F, R	F, R, S, L	F, R, S, L
Pickup switching; Feeder plan provides	Manual; Ties	Manual; Ties ,M-G sets	**Manual;** Nothing	None; Nothing	Manual; Ties

Today's Practices Build Their

PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	**2.4 delta;** Joint	12.47 Ygnd; Joint	12.47 Ygnd; Joint	**12.47** Ygnd; Joint	13.2 Ygnd; Joint
Feeder conductor; Kva rating	4/0 Cu; 1,000	**4 eq** ACSR; **3,000**	1/0 eq ACSR; 3,000	**2** eq ACSR; **1,000**	2/0 **Cu;** 4,000
Cable req'd by; Type preferred	Econ.; Non-met.	Not; None	Not; None	Not; None	Econ.; Lead
Lateral conductor type; Metal, %	Bare; **Cu, 90 Al 10**	Bare; ACSR 100	Bare; ACSR 100	Bare; ACSR 95, Cu 5	Bare; Cu 80, ACSR 20
Maint. (D)e-energ.; (R)ubber, (H)ot stick	R, H, Platform	D, H	D, H	D, H	H, Platform
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	3 to 37½ (5)	**5** to **25** (**5**)	5 to **50** (**5**)	5 to 250 (10)	**5** to 167 (**15**)
Preferred type; Load (S)um., (W)int., %	Int. bkr, conv; 100S, 110W	Int. bkr; 150S, . . .W	Conv; 140S, . . .W	Conv; 150S, . . .W	Conv; 140S, . . W
Overload relieved by	Repl. tsf.	Repl. tsf.	Repl. tsf.	Repl. tsf.	Repl. tsf., cut spacing
Taps req'd for voltage; Trend to 3ph	Yes; Yes	Yes; No	No; No	Yes; No	No; No
Ratings purch 3ph (Most common)	**45** to **45** (45)	None	None	None	15 to 150 (112½)
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	2 eq bare; Al 50 Cu 50	**4 eq** bare; ACSR 100	6 eq bare; ACSR 100	6 eq bare; ACSR 95, Cu 5	2 eq bare; **Cu 90, ACSR 10**
Banked; Network; % 3ph	No; No; 5	No; No; 0	No; No; 0	No; No; 1	No; No; **5**
Min. service size; Metal, %	**8; Cu 100**	8 eq; Al 80, Cu 20	6 eq **ACSR 66, Al 34**	**8** eq; **Cu 95, Al 5**	6 eq; **Cu 95, Al 5**
Services, % (W)ire, (C)able, (P)reassem.	**95W, 5C**	**80W, 20P**	**50W, 50P**	100P	**70W,** 30C
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	**100F**	100F	100F	100F	**90F, 10U**
Transformer bank SC kva	2,500	1,000	500 to 2,500	3,750	3,750
Subtransmission kv	. . .	66	66	66	**34.5,** 69
Normal load limit (S)um., (W)int., %	100S, 110W	110S, . . .W	125S, . . .W	100S, . . .W	100S, . . .W
Emerg. load limit (S)um., (W)int., %	110S, 125W	125S, 150W	150S, . . .	116S, . . .W	130S, . . .W
Sq mi/substa.; No. feeders/substa.	1; 2	100; 2	**100; 2**	**50; 2**	**4;** 3
Exits % (W)ire, (A)erial, (B)uried, (D)uct	100W	100W	100W	100W	**50W,** 5A, **45D**
VOLTAGE REGULATION					
Substa. tap changers; % Fdrs. with regulators	. . .; 95	No; 0	No; 0	. . .; 0	No; **60**
% Fdrs. with pole-mtd. (R)egulators; (P)ri. capac.; (S)ec. capac.	R 10; P 50; S . . .	R 20; P 100; S 0	R 10; **P 5;** S 0	**R 1;** **P 100;** S 0	**R 10; P 50; S 2**
% Primary capacitors—Unswitched; Switch by (T)ime; (V)olt; (A)mp; (O)ther	50 V 50	**77 T 20; V 2; A 1**	40 T 60	None **T 95; V 5**	50 **V 50**
SERVICE RELIABILITY					
Criterion	None	**120 min./yr**	. . .	. . .	. . .
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	R, S, L	F, R, L	F, R	F, R, S, L	F, R, S, L
Pickup switching; Feeder plan provides	Manual; Ties	Manual; Ties, M-G sets	**None;** Nothing	None; Nothing	Manual; Ties

built also. Field assembly continues the preferred construction by 2 to 1 ratio.

Capacitors, both primary and secondary, have attained widespread application. Trend for primary capacitors is toward 88% of circuits, while secondary capacitors move toward 40% from 33% today. Switching controlled by time, voltage, vars, and other means will continue on about 60% of primary capacitors.

Use of bare ACSR and aluminum for primaries moves toward 62% from today's 46%. On secondaries it approaches 73%, up from 50%. And the trend in services is 70% preassembled aluminum and ACSR.

From 9 Individual Electric Utility Companies

Rur. & Res.; 15.2%; 6	Res.; 7%; 7	Res.; 15%; 8	Res.; 20%; 9	Res.; 12%; 2	Res.; 13.2%; 3	Res.; 25%; 4
12.47 Ygnd; Joint 4/0 Cu; 3,000 . . . ; . . . Bare; ACSR . . ., Cu . . .	13.8 Ygnd; Joint 300 MCM Cu; 10,000 . . . ; . . . Bare; Cu 100	13.8 Ygnd; Joint 4/0 eq ACSR; 5,000 Econ.; . . . Bare; ACSR 100	13.2 Ygnd; Joint 4/0 eq Al; 7,500 Not; None Bare; Cu 75, Al 25	12.47 Ygnd; Joint 4/0 Cu; 5,000 Not; None Bare; Cu 50, ACSR 40, Al 10	12.47 Ygnd; Joint 300 MCM eq Al; 5,000 Not; None Bare; ACSR 100	12.47 Ygnd; Joint 4/0 eq Al; 5,000 Not; None Bare; ACSR 50, Al 40, Cu 10
D H	R, H, Platform	H, Platform	H	D, H	D, H	D, H
10 to 37½ (25) Conv; 133S, 133W	15 to 100 (50) Conv; 100S, . . .W	5 to 100 (25) Conv; 150S, . . .W	15 to 100 (50) Int. bkr; Bkr. trip	15 to 37½ (15) Int. bkr; 150S, . . .W	10 to 50 (50) Conv; 140S, .W	5 to 250 (25) Conv; 120S, . . .W
Repl. taf., cut spacing Yes; Yes . . .	Cut spacing Yes; No . . .	Cut spacing No; Yes . . . to . . . (150)	Cut spacing No; No None	Repl. taf., cut spacing . . .; No None	Repl. taf., cut spacing . . .; No None	Repl. taf., cut spacing Yes; No None
2 eq. bare; ACSR 100 Yes; No; 30 to 40 4 eq; Al 99	2 bare; Cu 100 No; No; 30 8; Cu 100	2 eq bare; ACSR 100 No; No; 20 6 eq; Al 67, ACSR 33	1 eq bare; Al 100 Yes; No; 25 6 eq; Al 100	2 eq bare; Cu 50, ACSR 50 Yes; No; 10 6 eq Al 80, Cu 20	2 eq bare; Al 100 Yes; No; 1 6 eq Al 67, ACSR 33	2 eq bare; Al 50, Cu 50 No; No; 15 6 eq; Al 50, Cu 50
99P	70W, 30C	100P	100P	100P	100P	100P
50F, 50U 7,500 66 133S, 133W 250S, 250W 2; 3 50W, 50D	45F, 35I, 20U 48,000 (FOA) 115 100S, . . .W 120S, . . .W 3 to 4; 10 to 12 100D	100U 12,000 115 100S, . . .W 167S, . . .W 9; 10 100D	100U 25,000 60, 132 100S, 100W 205S, 205W 4; 8 100D	99F, 1U 15,000 66 125S, . . .W 133S, 150W 25; 2 100W	100F 2,500 to 7,500 66 115S, . . .W 169S, . . .W 4; 6 95W, 5D	100F 7,500 66 100S, . . .W 125S, . . .W 9; 8 50W, 50D
Yes; None R . . .; P 100; S . . 50 T 40; V 10	Yes; 10 R . . .; P 100; S 100 70 T 10; V 20	Yes; 2 R . . .; P 100; S 100 35 T 20; V 35; A 5; O 5	Yes; None R 0; P 100; S 100 None T 50; O 50	Yes; 10 R 10; P 100; S 0 50 T 50	No; 5 R 0; P 75; S 0 40 T 50	Yes; 2 R 0; P 100; S 100 7 T 75; V 1; O 17
. . . F, R, L Manual; Ties, network	. . . L Manual; Ties	. . . .; Ties	. . . F, R, S Manual; Ties	60 min/yr F, L Manual; Ties	. . . F, R Manual; Ties	. . . F, R, S Manual; Ties

Distribution for Tomorrow's Loads

12.47 Ygnd; Joint 4/0 Cu; 1,500 . . . ; . . . Bare; Cu 80, ACSR 20 D, H	13.8 Ygnd; Joint 4/0 Cu; 8,000 . . . ; . . . Bare; Cu 100 R, H, Platform	13.8 Ygnd; Joint 4/0 eq ACSR; 5,000 Econ.; . . . Bare; ACSR 100 R, H, Platform	13.2 Ygnd; Joint 4/0 eq Al; 7,500 Not; None Bare; Cu 75, Al 25 H	12.47 Ygnd; Joint 4/0 Cu; 5,000 Not; None Bare; Cu 75, ACSR 23, D, H	12.47 Ygnd; Joint 4/0 eq Al; 5,000 Not; None Bare; ACSR 100 D, H	12.47 Ygnd; Joint 4/0 Cu; 5,000 Not; None Bare; ACSR 50, Cu 50 D, H
5 to 15 (10) Conv; 133S, 133W Repl. taf. Yes; No . . .	15 to 100 (37½) Conv; 100S, . . .W Repl. taf. Yes; No . . .	5 to 100 (25) Conv; 150S, 150W Cut spacing No; No 112½ to 150 (150)	10 to 100 (25) Int. bkr; Bkr. trip Cut spacing No; No None	10 to 37½ (15) Int. bkr; 150S, . . .W Repl. taf., cut spacing . . .; No None	10 to 50 (25) Conv; 140S, . . .W Repl. taf., cut spacing . . .; No None	5 to 250 (15) Conv; 120S, . . .W Cut spacing Yes; No None
4 bare; Cu 100 Yes; No; 10 8 eq; Cu 99, Al 1	2 bare; Cu 100 No; No; 20 8; Cu 100	2 eq bare; ACSR 100 No; No; 15 6 eq; Al 67, ACSR 33	1 eq bare; Al 75; Cu 25 Yes; No; 10 6 eq; Al 100	4 eq bare; Cu 80 ACSR 20 Yes; No; 5 6 eq Cu 60, Al 40	2 eq bare; Al 100 Yes; No; 0.5 6 eq; Al 50, ACSR 25, Cu 25	2 eq bare; Cu 90, Al 10 No; No; 5 6 eq; Cu 95, Al 5
99W, 1 P	80W, 20C	100P	2W; 98P	50W, 50P	25W, 75P	100P
50F, 50U 7,500 66 133S, 133W 250S, 250W 4; 3 50W; 50D	40F, 60I 48,000 (FOA) 115 100S, . . .W 120S, . . .W 5; 8 100D	100U 12,000 115 100S, . . .W 167S, . . .W 15; 5 100D	100U 12,000 60 100S, 100W 205S, 205W 12; 4 100D	99F, 1U 7,500 66 125S, . . .W 133S, 150W 25; 2 100W	100F 2,500 to 7,500 66 115S, . . .W 169S, . . .W 9; 6 to 9 100W	100F 7,500 66 100S, . . .W 125S, . . .W 25; 8 50W, 50D
Yes; None R . . .; P 100; S . . . 50 T 40; V 10	Yes; 10 R . . .; P 100; S 100 80 V 20	Yes; 2 R . . .; P 100; S 100 35 T 20; V 35; A 5; O 5	Yes; None R 0; P 100; S 100 None T 95; V 5	Yes; 10 R 10; P 100; S 0 75 T 25	No; 15 R 0; P 75; S 0 15 T 85	Yes; None R 0; P 100; S 0 3 T 96; V 1
. . . F, R, L Manual; Ties, network	. . . L Manual; Ties	. . . .; Ties	. . . F, R, S Manual; Ties	60 min/yr F, L Manual; Ties	. . . F, R None; Ties	. . . F, R, S Manual; Ties

West North Central Utilities . . .

Almost complete standardization on 12.47-kv distribution is also the trend of West North Central utilities. Already accepted by half the companies, indications are that 7.2 kv will be converted to 12.47 and all but one 2.4 or 4.0-kv system will shift to 12.47 or 13.2. Use of ACSR for primaries is predicted to approach 79% from today's 60%. But secondary conductors move upward to a conservative 25% total for aluminum or ACSR, predominantly covered.

Substation banks show a pronounced growth from 1,500 and 2,000 kva today to 5,000 and 7,500. But 3 to 4 is the expected number of feeders, making for conservative feeder loadings. Voltage regulating facilities are indicated for most

Future Trends in Distribution are Revealed in These Data

System type; Load growth; Co.	Rural; 15%; 1	Rural; 15%; 2	Rural; 12%; 3	Rural; 11%; 4	Rural; 15%; 5
PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	**13.2** Ygnd; Joint	12.45 Ygnd; Joint	12.47 Ygnd; Joint	**12.5 Ygnd; Joint**	**12.5 Ygnd;** Non joint
Feeder conductor; Kva rating	**1/0** eq ACSR; **1,500**	1 eq ACSR; **3,000**	2 eq ACSR; 2,400	**4** eq ACSR; **1,500**	6 eq ACSR; **2,000**
Cable req'd by; Type preferred	Not; None	Not; None	Trees, appear.; . . .	Not; None	Not; None
Lateral conductor type; Metal, %	Bare; ACSR 100	Bare; ACSR 100	Bare; ACSR 100	Bare; ACSR 100	Bare; ACSR 70, Cu 30
Maint. (D)e-energ., (R)ubber, (H)ot stick	H, Platform	H	D, H	D, **H**	H, Platform
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	5 to 50 (5)	**10** to **37½** (**10**)	**10** to 50 (**10**)	**10** to **50** (**10**)	5 to **15** (**10**)
Preferred type; Load (S)um., (W)int., %	Int. bkr; 120S, 150W	Int. bkr; 130S, 150W	Int. bkr; 113S, 150W	Int. bkr; 150S, 150W	Ld. ind.; 125S, 135W
Overload relieved by	Repl. taf.	Repl. taf.	Repl. taf.	Repl. taf.	Repl. taf.
Taps req'd for voltage; Trend to 3ph	No; No	Yes; No	No; Yes	Yes; No	Yes; No
Ratings purch 3ph (Most common)	None	None	30 to 45 (. . .)	None	None
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	6 eq, cov'd; **ACSR 100**	6 bare; Cu 100	2 eq cov'd; Cu 95, ACSR 5	2 cov'd; Cu 100	4 cov'd; Cu 100
Banked; Networked; % 3ph	No; No; Few	No; No; . . .	No; No; 0	No; No; 0	No; No; 5
Min. service size; Metal, %	6 eq; Al 100	6; Cu 100	4 eq; Al 100	6 eq; **Al 60, ACSR 25,** Cu 15	6; Cu 100
Services, % (W)ire, (C)able, (P)reassem.	100P	100W	100W	15W, 85P	95W, 5P
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	**80F, 20U**	**95F, 5U**	100F	**80F, 20U**	100F
Transformer bank SC kva	1,500	**2,500**	**5,000**	**500** to **2,500**	**1,500**
Subtransmission kv	**33**	69	34.5	34.5	34.5, 69
Normal load limit (S)um., (W)int., %	130S, 150W	125S, 135W	105S, 130W	125S, 125W	125S, 135W
Emerg. load limit (S)um., (W)int., %	130S, 150W	ASA	130S, 160W	125S, 125W	150S, 150W
Sq mi/substa.; No. feeders/substa.	**80; 3**	**30; 2**	**32; 3**	15; 2	25; 1 to 2
Exits % (W)ire, (A)erial, (B)uried, (D)uct	100W	98W, 2D	95W, 5D	100W	100W
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	. . .; None	No; 100	**Yes;** None	No; **50**	No; 100
% Fdrs. with pole-mtd. (R)egulators;	**R 10;**	**R 40;**	**R 20;**	**R 10;**	**R 20;**
(P)ri. capac.; (S)ec. capac.	P Few; S 0	P Few; S 0	P Few; S 0	**P 50;** S 0	P 10; S 0
% Primary capacitors—Unswitched;	100	100	100	**80**	None
Switch by (T)ime; (V)olt; (A)mp; (O)ther	None	None	None	**V 20**	V 100
SERVICE RELIABILITY					
Criterion	. . .	None	60 min/yr	. . .	. . .
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	F, R, S	F, R, S	F, R, S	F, R, S	F, R, S
Pickup switching; Feeder plan provides	Manual; Ties	Manual; Nothing	Manual; Ties	Manual; Nothing	Manual; Nothing

Today's Practices Build Their

PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	**12.47** Ygnd; Joint	12.45 Ygnd; Joint	12.47 Ygnd; Joint	**7.2 delta; Non joint**	**7.2 delta;** Non joint
Feeder conductor; Kva rating	**6** eq ACSR; **1,000**	1 eq ACSR; **2,000**	1 eq ACSR; 2,400	**6** eq ACSR; **1,000**	6 eq ACSR; **1,000**
Cable req'd by; Type preferred	Not; None	Not; None	Trees, appear.; None	Not; None	Not; None
Lateral conductor type; Metal, %	Bare; ACSR 100	Bare; ACSR 100	Bare; ACSR 100	Bare; ACSR 100	Bare; ACSR 70, Cu 30
Maint. (D)e-energ.; (R)ubber, (H)ot stick	H, Platform	H	D, H	D, **H**	H, Platform
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	5 to 50 (5)	**5** to **25** (**5**)	5 to 50 (**5**)	**5** to **25** (**5**)	5 to **10** (**5**)
Preferred type; Load (S)um., (W)int., %	Int. bkr; 120S, 150W	Int. bkr; 130S, 150W	Int. bkr; 113S, 150W	Int. bkr; 150S, 150W	Ld. ind.; 125S, 135W
Overload relieved by	Repl. taf.	Repl. taf.	Repl. taf.	Repl. taf.	Repl. taf.
Taps req'd for voltage; Trend to 3ph	No; No	Yes; No	No; Yes	Yes; No	Yes; No
Ratings purch 3ph (Most common)	None	None	30 to 45 (. . .)	None	None
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	6 cov'd; **Cu 100**	6 bare; Cu 100	2 eq cov'd; Cu 95, ACSR 5	2 cov'd; Cu 100	4 cov'd; Cu 100
Banked; Network; % 3ph	No; No; Few	No; No; . . .	No; No; 0	No; No; 0	No; No; 5
Min. service size; Metal, %	6 eq; Al 100	6; Cu 100	4 eq; Al 100	6 eq; **Al 70, ACSR 15,** Cu 15	6; Cu 100
Services, % (W)ire, (C)able, (P)reassem.	100P	100W	100W	15W, 85P	95W, 5P
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	**90F, 10U**	**100F**	100F	**100F**	100F
Transformer bank SC kva	1,500	**1,500**	**1,500** to 5,000	**150** to **1,500**	**1,000**
Subtransmission kv	**33**	**13, 24, 34,** 69	34.5	**13.8, 34.5**	**34.5,** 69
Normal load limit (S)um., (W)int., %	130S, 150W	125S, 135W	105S, 130W	125S, 125W	125S, 135W
Emerg. load limit (S)um., (W)int., %	130S, 150W	ASA	130S, 160W	125S, 125W	150S, 150W
Sq mi/substa.; No. feeders/substa.	**100; 2**	**40; 1** to 2	**64; 3**	15; 2	25; 1 to 2
Exits % (W)ire, (A)erial, (B)uried, (D)uct	100W	98W, 2D	95W, 5D	100W	100W
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	. . .; None	No; 100	**No;** None	No; **15**	No, 100
% Fdrs. with pole-mtd. (R)egulators;	**R 4;**	**R 20;**	**R 10;**	**R 5;**	**R 35;**
(P)ri. capac.; (S)ec. capac.	P Few; S 0	P Few; S 0	P Few; S 0	**P 30;** S 0	P 10; S 0
% Primary capacitors—Unswitched;	100	100	100	**100**	None
Switch by (T)ime; (V)olt; (A)mp; (O)ther	None	None	None	**None**	V 100
SERVICE RELIABILITY					
Criterion	. . .	. . .	60 min/yr	. . .	. . .
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	F, R, S	F, R, S	F, R, S	F, R, S	F, R, S
Pickup switching; Feeder plan provides	Manual; Ties	Manual; Nothing	Manual; Ties	Manual; Nothing	Manual; Nothing

feeders, either by load-tap-changing substation transformers or feeder regulators.

Use of capacitors is low, but trending upward toward a predicted 36% for primary capacitors. Time clocks are the preferred control, but 75% will remain unswitched.

Conspicuous in the replies from this area is the 100% acceptance of distribution transformers with built-in protection. But one company indicates a desire for load indication instead of breakers for future transformers.

This area ranks highest in co-op expenditures. Recent years have seen upwards of 25% of all distribution expenditures controlled by the co-ops.

From 7 Individual Electric Utility Companies

Rural; 5 to 10%; 6	Rur. & Res.; 7%; 7	Res.; 16%; 1	Res.; 20%; 2	Res.; 10%; 3	Res.; 12%; 4	Res.; 6%; 5
12.5 Ygnd; . . . . Cov'd;	12.47 Ygnd; Joint 4/0 eq ACSR; 4,000 Trees; Non-met. Bare; ACSR 100 H	13.2 Ygnd; Joint 400 MCM eq Al; 6,000 Trees, congest.; . . . Bare; ACSR 100 H, Platform	12.45 Ygnd; Joint 4/0 eq Al; 7,500 Not; None Bare; ACSR 80, Cu 20 H	12.47 Ygnd; Joint 2 Cu; . . . . . .; . . . Bare; Cu 100 H	4.16 Ygnd; Joint 1/0 Cu; 2,000 Trees, appear.; Non-met. Bare; ACSR 100 R	4.16 Ygnd; Joint 4/0 Cu; 2,500 Econ., trees; Non-met. Cov'd; Cu 95, Al 3, R
. . . .	5 to 37½ (25) Int. bkr; 125S, 150W Cut spacing, repl. taf. Yes; No Few	25 to 75 (25) Int. bkr; 120S, 150W Cut spacing, repl. taf. No; Yes . . .	15 to 37½ (25) Int. bkr; 125S, 150W Cut spacing, repl. taf. No; No None	25 to 50 (37½) Int. bkr; 113S, 150W Repl. taf., cut spacing No; No None	10 to 50 (25) Int. bkr; 120S, 120W Cut spacing, repl taf. Yes; No None	15 to 50 (25) Int. bkr; 125S, 125W Cut spacing, repl. taf. Yes; No . . .
. . . .	2 bare; Cu 100 No; No; 0 6 eq; Al 100 100C	2 eq cov'd; Al 50, Cu 50 Yes; No; 5 4 eq; Al 100 100P	2 eq cov'd; ACSR 50, Cu 50 Yes; No; 0 6 eq; Al 95, Cu 5 90W, 10P	2 cov'd; Cu 100 Yes; No; 0 6 eq; Al 95, Cu 5 100W	2 eq cov'd; Al 100 Yes; Yes; 10 6 eq; Al 80, ACSR 25, Cu 15 15W, 85P	2 cov'd; Cu 100 Yes; No; 30 to 40 6 eq; Al 53, ACSR 27, Cu 20 20W, 80P
. . . .	80F, 20U 7,500 69 110S, 125W 133S, 150W 16; 5 100W	100U 5,000 66 130S, 150W 130S, 150W 25; 4 90W, 3A, 3B, 4D	100F 15,000 69, 115 . . .S, . . .W ASA 15; 4 to 6 100D	20F, 80U 5,000 34.5 130S, 160W 160S, 200W 2; 3 to 4 10W, 90D	100U 2,000 34.5 100S, 100W 200S, 200W 1½; 3 to 4 100D	60F, 40U 2,000 34.5, 69 125S, 125W 150S, 150W 2; 4 100D
. . . .	Yes; 10 R 5; P 100; S Few 40 T 60	Yes; None R 0; P 0; S 0 None None	No; 100 R 0; P 0; S 0 None None	Yes; None R 0; P 0; S 0	Yes; 100 R 50; P 75; S 0 70 T 10; V 10; A 10	Yes; 60 R 10; P 100; S Study 71 A 29
. . . .	. . . F, R, L Manual; Ties, network	. . . F, R, S Manual; Ties	. . . F, R, S Manual; Ties	40 min/yr F, R, S Manual; Ties	. . . F, R, S Man., auto.; Sp fdr., ties	. . . F, R, S, L Manual; Spare fdr., ties

Distribution for Tomorrow's Loads

4.16 Ygnd; Joint 2/0 eq Cu; 1,000 . . . . . . Cov'd; Cu 90, ACSR 10 D, R, H, Platform	12.47 Ygnd; Joint 4/0 eq ACSR; 4,000 Trees; Non-met. Bare; ACSR 100 H	12.47 Ygnd; Joint 300 MCM eq Al; 5,000 Trees, congest.; . . . Bare; ACSR 90, Cu 10 H, Platform	12.45 Ygnd; Joint 4/0 eq Al; 7,500 Not; None Bare; ACSR 80, Cu 40 H	4.16 Ygnd; Joint 4/0 Cu; 2,250 . . .; . . . Bare; Cu 100 R	4.16 Ygnd; Joint 1/0 Cu; 2,000 Trees, appear.; Non-met. Cov'd; Cu 100 R	2.4 delta; Joint 4/0 Cu; 2,500 Econ., trees; Non-met. Cov'd; Cu 95, Al 3, R
5 to 167 (15 & 25) Int. bkr; . . . Repl. taf., cut spacing Yes; Special . . .	5 to 37½ (25) Int. bkr; 125 S, 150W Cut spacing, repl. taf. Yes; No Few	10 to 75 (15) Int. bkr; 120S, 150W Cut spacing, repl. taf. No; Yes None	15 to 25 (25) Int. bkr; 125S, 150W Cut spacing, repl. taf. No; No None	25 to 37½ (25) Int. bkr; 113S, 150W Repl. taf., cut spacing No; No None	5 to 50 (15) Int. bkr; 120S, 120W Cut spacing, repl. taf. Yes; No 50 to 50 (50)	15 to 50 (15) Int. bkr; 125S, 135W Cut spacing, repl. taf Yes; No None
4 to 2/0 eq cov'd; Cu 90, ACSR 10 Yes; No; 20 6 eq; Cu 90, ACSR 10 95W, 5P	2 bare; Cu 100 No; No; 0 6 eq; Al 100 100C	2 eq cov'd; Cu 90, Al 10 Yes; No; 2 4 eq; Al 100 100P	2 eq cov'd; ACSR 50, Cu 50 Yes; No; 0 8 eq; Al 90; Cu 10 100W	2 cov'd; Cu 100 No; No; 0 8 eq; Al 95, Cu 5 100W	2 eq cov'd; Cu 90, Al 8, ACSR 2 Yes; Yes; 1 6 eq; Al 70, ACSR 15, Cu 15 15W, 85P	2 eq cov'd; Cu 98, Al 2 Yes; No; 8 6 eq; Cu 70, ACSR 30 70W, 1C, 29P
75F, 25U 300 to 3,000 12.5 100S, 125W 125S, 150W . . .; 1 to 4 100W	80F, 20U 7,500 69 110S, 125W 133S, 150W 16; 5 100W	100U 1,500 to 5,000 33 130S, 150W 130S, 150W 25; 3 to 4 100W	100F 15,000 69,115 . . .S, . . .W ASA 30; 2 100D	100U 5,000 34.5 130S, 160W 160S, 200W 2; 3 to 4 100W	100U 2,000 13.8 to 34.5 100S, 100W 200S, 200W 2; 1 100D	80F, 20U 2,000 34.5, 69 125S, 125W 150S, 150W 4; 2 100D
Yes; 50 R 5; P 5; S 0 100 None	Yes; 10 R 5; P 100; S Few 45 T 55	Yes; None R 0; P 0; S 0 None None	No; 100 R 0; P 0; S 0 None None	Yes; None R 0; P 0; S 0	Yes; 100 R 5; P 50; S 0 100 None	Yes; 80 R 10; P 25; S 0 71 A 29
None F, S, L Man.; auto; Ties.	. . . F, R, L Man.; Ties, netw.	. . . F, R, S Manual; Ties	. . . F, R, S Manual; Ties	40 min/yr F, R, S Manual; Ties	. . . F, R, S Man.; Spare fdr., ties	. . . F, R, S, L Man.; Spare fdr., ties

Mountain States Utilities . . .

Geographically very different, the Mountain and East South Central areas share several characteristics. Their expenditures for distribution rank lowest among the survey areas, and co-operatives direct about a quarter of the total. Both areas report a heavy trend to 3-phase secondaries, 24% in the mountains and 15% in the south. But only one utility uses 3-phase transformers or expects a trend toward them.

Mountain States utilities lean 87% to 12.47 and 13.2 kv feeder voltages, with some of the heaviest feeder loadings reported. Their use of primary capacitors is high, with a pronounced trend toward current and voltage controlled

Future Trends in Distribution are Revealed in These Data

System type; Load growth; Co.	Rural; 10 to 15%; 1	Rur. & Res.; 11%; 2	Rur. & Res.; 12.5%; 3	Rur. & Res.; 8%; 4	Res.; 8 to 10%; 1
PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	12.5 Ygnd; Joint	13.2 Ygnd; Joint	12.5 Ygnd; Joint	12.47 Ygnd; Joint	4.16 Ygnd; Joint
Feeder conductor; Kva rating	4 eq ACSR; 500	4/0 eq ACSR; 8,000	4/0 Cu; 8,000	2 Cu; 3,000	4/0 eq Al; 1,800
Cable req'd by; Type preferred	. . .; . . .	Trees; Non-met.	. . .; . . .	Trees; Non-met.	. . .; . . .
Lateral conductor type; Metal, %	Bare; ACSR 100	Bare; ACSR 100	Bare; Cu 90, ACSR 10	Bare; ACSR 40, Cu 30, Cwd 30	Bare; ACSR 80, Al 20
Maint. (D)e-energ., (R)ubber, (H)ot stick	H	D, H	H	D, H	R
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	10 to 50 (10)	15 to 167 (25)	10 to 75 (37½)	5 to 250 (5 & 37½)	10 to 100 (25)
Preferred type; Load (S)um., (W)int., %	Int. bkr; . . ., 140W	Int. bkr; . . ., 160W	Conv; 140S, . . .W	Int. bkr; 135S, 150W	Int. bkr; . . ., 140W
Overload relieved by	Repl. taf.	Cut spacing	Repl. taf., cut spacing	Repl. taf., cut spacing	Repl. taf., cut spacing
Taps req'd for voltage; Trend to 3ph	Yes; No	Yes; No	Yes; No	Yes; No	Yes; No
Ratings purch 3ph (Most common)	. . .	. . .	. . .	. . .	. . .
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	6 eq bare; ACSR 100	4 eq bare; ACSR 100	2 cov'd; Al 100	2 bare; Cu 100	4 eq bare; ACSR 100
Banked; Networked; % 3ph	No; No; 0	Yes; No; 5	No; No; 90	No; No; 5	Yes; No; 0
Min. service size; Metal, %	6 eq; Al 100	8 eq; Al 67, ACSR 33	6 eq; Al 100	6 eq; Al 80, Cu 20	6 eq; Al 100
Services, % (W)ire, (C)able, (P)reass.	95P	100P	100P	20W, 80P	100P
DISTRIBUTION SUBSTATIONS					
% (F)ield, (I)ndoor, (U)nit	100F	25F, 75U	100F	100F	100F
Transformer bank SC kva	300 to 5,000	2,500	12,000	5,000 to 10,000	5,000 to 10,000
Subtransmission kv	23 to 100	. . .	69	46, 69, 138	23 to 100
Normal load limit (S)um., (W)int., %	. . .S, 140W	100S, 125W	133S, . . .W	125S, 135W	. . .S, 140W
Emerg. load limit (S)um., (W)int., %	130S, 160W	125S, 150W	167S, . . .W	150S, 160W	130S, 160W
Sq mi/substa.; No. feeders/substa.	150; 2	4; 4	1.6; 4	130 to 150; 3 to 4	6 to 8; 8
Exits % (W)ire, (A)erial, (B)uried, (D)uct	100W	100D	100W	20W, 80D	100W
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with reg'rs	No; . . .	Yes; None	No; 50	Yes; None	No; None
% Fdrs. with pole-mtd. (R)egulators;	R 60;	R 0;	R 0;	R 95;	R . . .;
(P)ri. capac.; (S)ec. capac.	P 25; S . .	P 50; 80	P 100; S 100	P 100; S . . .	P 50; S . . .
% Primary capacitors—Unswitched;	40	50	30	50	60
Switch by (T)ime; (V)olt; (A)mp; (O)ther	V 40; A 20	A 80	A 70	V 10; A 40	V 10; A 30
SERVICE RELIABILITY					
Criterion	None	None	. . .	. . .	Possible
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	R, L	F, R, S, L	F, R	F, R, S, L	R, L
Pickup switching; Feeder plan provides	Manual; Ties	Manual; Ties	Auto.; Ties, network	Man.; Ties, network	Auto.; Ties, network

Today's Practices Build Their

PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	12.5 Ygnd; Joint	13.2 Ygnd; Joint	12.5 Ygnd; Joint	12.47 Ygnd; Joint	4.16 Ygnd; Joint
Feeder conductor; Kva rating	4 eq ACSR; 500	4/0 eq ACSR; 8,000	4/0 Cu; 8,000	2 Cu; 2,000	4/0 eq Al; 1,800
Cable req'd by; Type preferred	. . .; . . .	Not; Non-met.	. . .; . . .	Trees; Non-met.	. . .; . . .
Lateral conductor type; Metal, %	Bare; ACSR 100	Bare; ACSR 100	Bare; Cu 90, ACSR 10	Bare; Cu 70, Cwd 29, ACSR 1	Bare; ACSR 81, Al 15, Cu 4
Maint. (D)e-energ.; (R)ubber, (H)ot stick	H	D, H	H	D, H	R
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	5 to 50 (5)	10 to 167 (15)	10 to 75 (25)	3 to 200 (3 & 25)	5 to 100 (15)
Preferred type; Load (S)um., (W)int., %	Int. bkr; . . ., 140W	Int. bkr; . . ., 160W	Conv; 140S, . . .W	Int. bkr; 135S, 150W	Int. bkr; . . ., 140W
Overload relieved by	Repl. taf.	Cut spacing	Repl. taf., cut spacing	Repl. taf., cut spacing	Repl. taf., cut spacing
Taps req'd for voltage; Trend to 3ph	Yes; No	Yes; No	Yes; No	Yes; No	Yes; No
Ratings purch 3ph (Most common)	. . .	. . .	. . .	. . .	. . .
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	6 eq bare; ACSR 100	4 eq bare; ACSR 100	2 cov'd; Al 90, Cu 10	4 bare; Cu 100	4 eq bare; ACSR 100
Banked; Networked; % 3ph	No; No; 0	Yes; No; 0	No; No; 90	No; No; 5	Yes; No; 0
Min. service size; Metal, %	6 eq; Al 100	8 eq; Al 100	6 eq; Al 90, Cu 10	6 eq; Al 80, Cu 20	6 eq; Al 100
Services, % (W)ire, (C)able, (P)reass.	80P	100P	10W, 90P	20W, 80P	100P
DISTRIBUTION SUBSTATIONS					
% (F)ield, (I)ndoor, (U)nit	100F	25F, 75U	100F	100F	100F
Transformer bank SC kva	150 to 2,000	2,500	12,000	3,750 to 10,000	3,000 to 5,000
Subtransmission kv	23 to 100	. . .	69	46, 69, 138	23 to 100
Normal load limit (S)um., (W)int., %	. . ., 140W	100S, 125W	133S, . . .W	125S, 135W	. . .S, 140W
Emerg. load limit (S)um., (W)int., %	130S, 160W	125S, 150W	167S, . . .W	150S, 160W	130S, 160W
Sq mi/substa.; No. feeders/substa.	100; 1	4; 4	2.5; 4	130 to 150; 2 to 3	12; 4
Exits % (W)ire, (A)erial, (B)uried, (D)uct	100W	100D	100W	30W, 70D	100W
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with reg'rs	No; . . .	Yes; None	No; 90	Yes; 3	No; None
% Fdrs. with pole-mtd. (R)egulators;	R 30;	R 0;	R 0;	R 70;	R . . .;
(P)ri. capac.; (S)ec. capac.	P5; S 0	P 50; S 0	P 100; S 0	P 95; S . . .	P 25; S . . .
% Primary capacitors—Unswitched;	90	100	30	85	60
Switch by (T)ime; (V)olt; (A)mp; (O)ther	V 10	None	A 70	V 3; A 12	V 35; A 5
SERVICE RELIABILITY					
Criterion	None	None	. . .	. . .	None
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	R, L	F, R, S, L	F, R	F, R, S, L	R, L
Pickup switching; Feeder plan provides	Manual; Ties	Manual; Ties	Man.; Ties, network	Man.; Ties, network	Man.; Ties, network

East South Central Utilities . . .

switching. Replies indicate a trend to 75% use of aluminum and ACSR for secondaries and to 95% preassembled aluminum service drops.

East South Central utilities also show some trend toward preassembled services. But most noteworthy is their use of aerial and direct-buried cable for feeder exits from substations. By this departure from customary underground practice they appear to have almost eliminated cable ducts despite the trend toward 4-feeder substations.

Their preference in feeder voltage remains 75% for 4.16 kv despite a growth rate of 12.3%. Load rating for these feeders is uncommonly high.

From 10 Individual Electric Utility Companies

Rural; 10.8%; 1	**Rur. & Res.; 18%; 2**	**Rur. & Res.; 8%; 3**	**Res.; 20 to 30%; 4**	**Res.; 5%; 5**	**Res.; 10%; 6**	**Res.; 11.1%; 1**
12 Ygnd; Joint	13.8 Ygnd; Joint	4.16 Ygnd; Joint	4.16 Ygnd; Joint	4.16 Ygnd; Joint	4.16 Ygnd; Joint	4 Ygnd; Joint
2 eq ACSR; 1,750	4/0 eq **Al**; 5,000	4/0 Cu; 2,100	4/0 Cu; 3,000	2/0 eq Al; 2,800	4/0 Cu; 1,200	2/0 eq **Al**; 1,750
Not; None	Econ.; **Shielded**	. . .; . . .	Not; None	Trees, congest.; Non-met.	Trees; Non-met.	Trees; Non-met.
Bare; **ACSR 95, Cu 5**	Bare; **ACSR 90, Al 5, Cu 5**	Bare; **Cu 85, ACSR 15**	Cov'd; **Cu 75, Al 25**	Bare; **Cu 80, Al 20**	Bare; Al 50, Cu 50	Bare; **Cu 50, ACSR 30, Al 20**
H	H, Platform	R	R	R	D, R	R, Platform
10 to 250 (15)	**5 to 100 (25)**	10 to 250 (**25**)	25 to 50 (25)	**25 to 75 (37½)**	**25 to 75 (37½)**	**15 to 250 (25)**
Int. bkr; 135S, 135W	Conv; 150S, . . .W	Conv; 150S, 150W	Conv; . . ., **175W**	**Int. bkr;** 125S, 166W	Conv; 160S, 160W	**Ld. ind;** 135S, 135W
Cut spacing, repl. taf.	Repl. taf., cut spacing	Cut spacing	Cut spacing	Cut spacing, repl. taf.	Repl. taf.	Cut spacing, repl. taf.
. . .; No	Yes; **Yes**	No; No	No; No	No; No	Yes; No	. . .; No
. .	75 to 150 (112½)	. . .	None	None	None	None
2 eq bare; ACSR 95, Cu 5	2 eq bare; **Al 50, ACSR 40,** Cu 10	3 eq cov'd; **Cu 90, ACSR 10**	2 eq cov'd; **Al 75, Cu 25**	1/0 eq cov'd; **Cu 80, Al 20**	**1/0** eq bare; Cu 50, Al 50	2 eq cov'd; **Cu 85, ACSR 15**
No; No; **15**	**Yes; Yes; 10**	No; No; **50**	No; No; 1	No; No; **2**	Yes; No; 5	No; No; **25**
8 eq; Cu 100	8 eq; Al 50, Cu 50	8 eq; **Cu 75, ACSR 25**	6 eq; Al 100	6 eq; Al 100	4 eq; Al 75, Cu 25	8; Cu 100
100W	**90W, 10P**	**75W, 25P**	100P	100P	50W, 50P	**98W, 2C**
95F, 5U	100F	**90F, 10U**	**20F, 80U**	**75F, 25U**	100U	60F, 40U
2,500	10,000 & 12,000	. . .	5,000	5,000 to 7,500	**3,750**	**3,750**
44	115	**44**	**44**	13.8, 69	13.8	**44**
100S, 115W	ASA	115S, 120W	. . .S, 150W	110S, 167W	100S, 100W	100S, 115W
150S, 150W	ASA	150S, 150W	175S, 200W	150S, 200W	150S, 150W	150S, 150W
27; 4	**200; 7**	. . .; **4**	**1**; 2	1; **6**	½ to 2; 3	1; **4**
100W	**98.7W, 0.4A, 0.9D**	**90W, 10A**	100B	**75W, 25A**	100B	**90W, 10D**
Yes; None	No; None	No; **95**	Yes; **33**	No; **10**	. . .; None	Yes; **20**
R 2;	**R 45;**	**R 25;**	**R 3;**	R 2;	R 0;	R 2;
P . . .; S . . .	**P 75; S 20**	**P 90;** S . . .	P . . .; S . . .	P 100; S 75	**P 75; S Poss.**	**P 0;** S . . .
100;	**70;**	**75;**	100;	**100;**	100;	**100;**
None	**T 15; V 15**	**V 10; A 15**	None	None	None	**None**
. . .	None	. . .	None	60 min/yr	. . .	. . .
F, R, S	F, R, S, L	F, R, S, L	R, S	F, R, S, L	F, R, S, L	F, R, S
None; Ties	None; Ties	**Man.; auto.;** Ties, netw.	Manual; Ties	Manual; Ties	Manual; Ties, netw.	None; Ties

Distribution for Tomorrow's Loads

12 Ygnd; **Joint**	**13.8 Ygnd; Joint**	**4.16 Ygnd;** Joint	4.16 Ygnd; Joint	4.16 Ygnd; Joint	4.16 Ygnd; Joint	4 Ygnd; Joint
2 eq ACSR; 1,750	4/0 eq **ACSR**; 5,000	4/0 Cu; 2,100	4/0 Cu; 3,000	4/0 Cu; 3,000	4/0 Cu; 1,000	2/0 **Cu**; 1,750
Not; None	Econ.; **Lead**	. . .; . . .	Not; None	Trees, congest; Non-met.	Trees; Non-met.	Trees; Non-met.
Bare; **ACSR 90, Cu 10**	Bare; **ACSR 89, Cu 10, Cwd 1**	Bare; **Cu 90, ACSR 10**	Cov'd; **Cu 100**	Bare; **Cu 100**	Bare; Al 50, Cu 50	Bare; **Cu 90, ACSR 10**
D	H, Platform	R	R	R	D, R	R, Platform
5 to 167 (10)	**3 to 100 (25)**	10 to 250 (**15**)	25 to 250 (25)	**15 to 75 (25)**	**15 to 60 (25)**	**10 to 167 (15)**
Int. bkr; 135S, 135W	Conv; 150S, . . .W	Conv; 150S, 150W	Conv; . . .S, **150W**	**Conv;** 125S, 166W	Conv; 160S, 160W	**Conv;** 135S, 135W
Cut spacing, repl. taf.	Repl. taf., cut spacing	Cut spacing	Cut spacing	Cut spacing, repl. taf.	Repl. taf.	Cut spacing, Repl. taf.
. . .; No	Yes; **No**	No; No	No; No	No; No	Yes; No	. . .; No
. . .	75 to 150 (112½)	. . .	None	None	None	. .
6 eq bare; **ACSR 90, Cu 10**	2 eq bare; **ACSR 90,** Cu 10	3 eq cov'd; **Cu 95, ACSR 5**	2 eq covd; **Cu 75, Al 25**	1/0 cov'd; **Cu 100**	2 eq bare; Al 50, Cu 50	2 eq cov'd; **Cu 90, ACSR 9, Al 1**
No; No; **5**	**No; No; 1**	No; No; **25**	No; No; 1	No; No; **1**	Yes; No; 5	No; No; **10**
8 eq; Cu 100	8 eq; Al 50, Cu 50	8 eq; **Cu 90, ACSR 10**	6 eq; Al 100	6 eq; Al 100	6 eq; Al 75, Cu 25	8; Cu 100
100W	**99W, 1P**	**100W**	100P	100P	50W, 50P	**98W, 1.5C, 0.5P**
95F, 5U	100F	**100F**	**33F, 67U**	**80F, 20U**	100U	60F, 40U
2,500	10,000 & 12,000	. . .	5,000	5,000 to 7,500	**3,000**	**2,500**
44	115	**44**	**12.5, 44**	13.8, 69	13.8	**44**
100S, 115W	ASA	115S, 120W	. . .S, 150W	110S, 167W	100S, 100W	100S, 115W
150S, 150W	ASA	150S, 150W	175S, 200W	150S, 200W	150S, 150W	150S, 150W
100; 2	**500; 5**	. . .; **2**	**2**; 2	1; **3**	**1 to 4**; 3	1; **2**
100W	**99.3W; 0.2A; 0.5D**	**100W**	100B	**95W, 5A**	100B	**95W, 5D**
Yes; None	No; None	No; **90**	Yes; **67**	No; **15**	. . .; None	Yes; **35**
R 2;	**R 30;**	**R 5;**	**R 0;**	R 2;	R 0;	R 2;
P . . .; S . . .	**P 85; S 10**	**P 85;** S 0	P . . .; S . .	P 100; **S 0**	P 50; S 0	**P 5;** S . . .
95;	**95;**	**100;**	100;	100;	100;	**95;**
V 5	**T 5**	None	None	None	None	**V 5**
. . .	None	. . .	None	60 min/yr	. . .	. . .
F, R, S	F, R, S, L	F, R, S, L	R, S	F, R, S, L	F, R, S	F, R, S
None; Ties	None; Ties	**Manual;** Ties	**Manual;** Ties	**Manual;** Ties	**Manual;** Ties, netw.	None; Ties

Rural Cooperatives . . .

No survey of distribution trends could be complete without a section devoted to rural cooperatives. Upwards of 1,000 systems across the nation serve only about 8% of total electric customers. But among their customers are nearly half of the farms of America.

Capital expenditures of these rural systems run about 10% of the electrical industry total for distribution. Nearly half of the co-op expenditures are in the West North Central, East South Central, and Mountain states, where they approximate 25% of industry distribution expenditures.

Included in this survey are 17 rural cooperatives. Their reported annual growth exceeds that of neighboring utili-

Future Trends in Distribution are Revealed in These Data

System location; Load growth; No.	W. No. Cent.; 10%; 1	W. No. Cent.; 13%; 2	W. No. Cent.; 11%; 3	W. No. Cent.; 10%; 4	W. No. Cent.; 12%; 5
PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	24.9 Ygnd; **Possible**	12.5 Ygnd; Joint	12.5 Ygnd; **Possible**	12.5 Ygnd; No	12.5 Ygnd; No
Feeder conductor; Kva rating	4 eq ACSR; 2,500	2 eq ACSR; 400 to 1,000	4 eq ACSR; 500	6 to 1/0 eq ACSR; 1,000	8 eq ACSR, 400
Cable req'd by; Type preferred	. . .; . . .	Not; None	. . .; . . .	Not; None	. . .; . . .
Lateral conductor type; Metal, %	Cov'd; **ACSR 90, Cu 10**	Bare; **ACSR 100**	Bare; ACSR 100	Bare; ACSR 100	Bare; **ACSR 85, Cwd 15**
Maint. (D)e-energ., (R)ubber, (H)ot stick	D, **H**	D, H	D, R, H	. . .	R, H
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	**5 to 50 (5)**	5 to 25 (7½)	**5 to 25 (7½ & 10)**	5 to 10 (5)	**5 to 10 (5)**
Preferred type; Load (S)um., (W)int., %	Int. bkr; 150S, 150W	Conv; int. bkr; Kwhr	Conv; 150S, 150W	Int bkr.; 400S, 400W	Conv; int. bkr; Kwhr
Overload relieved by	Repl. taf., cut spacing	Repl. taf.	Repl. taf.	Repl. taf.	Repl. taf.
Taps req'd by voltage; Trend to 3ph	Yes; No	. . .; Yes	No; No	. . .; No	Yes; **Possible**
Ratings purch 3ph (Most common)	None	**30 to 75 (30)**	None	None	None
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	6 eq cov'd; **ACSR 60, Al 30, Cu 10**	4 eq cov'd; **Cu 90, Al 10**	4 eq cov'd; **ACSR 100**	4 eq cov'd; **ACSR 75, Cu 25**	6 eq cov'd; **Al 100**
Banked; Networked; % 3ph	No; No; **10**	No; No; . . .	No; No; **10**	No; No; 0	No; No; **5**
Min. service size; Metal, %	4 eq; **Al 60, ACSR 30, Cu 10**	6 eq; **Cu 90, Al 10**	6 eq; **Al 90, Cu 10**	6 eq; **ACSR 50, Cu 50**	6 eq; **Cu 90, Al 10**
Services, % (W)ire, (C)able, (P)reass.	10W, 90P	**90W, 10P**	**10C, 90P**	**50W, 50C**	**95W, 5C**
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	**100F**	**98F, 2U**	100U	100F	**98F, 2U**
Transformer bank SC kva	**2,500**	**667** (1ph)	500, **666** (1ph)	333 to 1,250 (1ph)	**667** (1ph)
Subtransmission kv	34.5	34.5 to **115**	69	34.5, 69	34.5, 69
Normal load limit (S)um., (W)int., %	. . .S, . . .W	125S, 125W	110S, 130W	100S, 120W	125S, 125W
Emerg. load limit (S)um., (W)int., %	150S, 175W	150S, 150W	130S, 150W	165S, 175W	150S, 150W
Sq mi/substa.; No. feeders/substa.	2,500; **4**	**400; 4**	**225; 4 to 6**	**280; 5 to 7**	**400; 4**
Exits, % (W)ire, (A)erial, (B)uried, (D)uct	100W	100W	100W	100W	100W
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	No; None	No; **1**	Yes; None	Yes; None	No; 100
% Fdrs. with pole-mtd. (R)egulators;	**R 2;**	**R 10;**	**R 100;**	R 10;	**R 100;**
(P)ri. capac.; (S)ec. capac.	P 0; S 0	**P 10;** S 0	P 0; **S 100**	**P 10;** S 0	**P Possible;** S 0
% Primary capacitors—Unswitched;	None	**100**	None	**100**	. . .
Switch by (T)ime; (V)olt; (A)mp; (O)ther	None	None	None	None	. . .
SERVICE RELIABILITY					
Criterion	. . .	None	**15 min/yr**	None	None
(F)uses, (R)eclosers, (S)ectionalisers (L)ine stds.	F, R	F, R, S, L	F, R, S, L	**F, R, S, L**	F, R, S, L
Pickup switching; Feeder plan provides	Manual; Network	**Manual**; Ties	**Automat.**; Ties	**Manual**; Network	**Manual**; Ties

Today's Practices Build Their

PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	24.9 Ygnd; **No**	12.5 Ygnd; Joint	12.5 Ygnd; **No**	12.5 Ygnd; **No**	12.5 Ygnd; **No**
Feeder conductor; Kva rating	4 eq ACSR; 2,500	2 eq ACSR; 400 to 1,000	4 eq ACSR; 500	6 to 1/0 eq ACSR; 1,000	8 eq ACSR 400
Cable req'd by; Type preferred	. . .; . . .	Not; None	. . .; . . .	. . .; None	. . .; . . .
Lateral conductor type; Metal, %	Cov'd; **Cu 95, ACSR 5**	Bare; **ACSR 90, Cu 10**	Bare; ACSR 100	Bare; ACSR 100	Bare; **ACSR 80, Cwd 2**
Maint. (D)e-energ.; (R)ubber, (H)ot stick	D	D, H	D, R, H	D, H	R, H
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	**3 to 50 (3)**	5 to 25 (**5**)	**1½ to 10 (3)**	5 to 10 (5)	**3 to 5 (3)**
Preferred type; Load (S)um., (W)int., %	Int. bkr; 150S, 150W	Conv; int. bkr; Kwhr	Conv; 150S, 200W	Int. bkr; 400S, 400W	Conv; int. bkr; Kwhr
Overload relieved by	Repl. taf., cut spacing	Repl. taf.	Repl. taf.	Repl. taf.	Repl. taf.
Taps req'd for voltage; Trend to 3ph	Yes; No	. . .; Yes	No; No	. . .; No	**Yes; No**
Ratings purch 3ph (Most common)	None	**15 to 50 (15)**	None	None	None
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	6 cov'd; **Cu 98, ACSR 2**	6 cov'd; **Cu 100**	6 cov'd; **Cu 90, Cwd 10**	**4 & 6 cov'd; Cu 100**	**6 eq cov'd; Cu 90, Al 10**
Banked; Network; % 3ph	No; No; **3**	No; No; . . .	No; No; **0.5**	No; No; 0	No; No; **1**
Min. service size; Metal, %	6; **Cu 98, ACSR 2**	6; **Cu 100**	6; **Cu 100**	6; **Cu 100**	6; **Cu 100**
Services, % (W)ire, (C)able, (P)reass.	. . .	**100W**	**10W, 90C**	**100W**	**100W**
DISTRIBUTION SUBSTATIONS					
% (F)ield assem., (I)ndoor, (U)nit	**100U**	**100F**	100U	100F	**100F**
Transformer bank SC kva	**1,000**	**500** (1ph)	**333** to 500 (1ph)	333 to 1,250 (1ph)	**500**
Subtransmission kv	34.5	34.5, 69	69	34.5, 69	34.5, 69
Normal load limit (S)um., (W)int., %	125S, 125W	125S, 125W	110S, 130W	100S, 120W	125S, 125W
Emerg. load limit (S)um., (W)int., %	150S, 175W	150S, 150W	130S, 150W	165S, 175W	150S, 150W
Sq mi/substa.; No. feeders/substa.	2,500; **2**	**700; 3**	**400; 3 to 4**	**500; 2 to 4**	**700; 3**
Exits, % (W)ire, (A)erial, (B)uried, (D)uct	100W	100W	100W	100W	100W
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	No; None	No; **10**	Yes; None	Yes; None	No; 100
% Fdrs. with pole-mtd. (R)egulators;	**R 0;**	**R 5;**	**R 50;**	R 10;	**R 5;**
(P)ri. capac.; (S)ec. capac.	P 0; S 0	**P 0;** S 0	P 0; S 0	**P 0;** S 0	**P 0;** S 0
% Primary capacitors—Unswitched;	None	**None**	None	**None**	None
Switch by (T)ime; (V)olt; (A)mp; (O)ther	None	None	None	None	None
SERVICE RELIABILITY					
Criterion	None	None	**30 min/yr**	None	None
(F)uses, (R)eclosers, (S)ectionalisers, (L)ine stds.	F, R	F, R, S, L	F, R, S, L	R, S, L	F, R, S, L
Pickup switching; Feeder plan provides	**Manual; Nothing**	**Manual**; Ties	**Manual**; Ties	**Manual; Network**	**Manual**; Ties

ties in nearly every area, just as their combined growth of 13.2% exceeds the 11.0% average for 89 utilities in this survey. This is but another indication that rural systems weigh heavily in molding tomorrow's distribution practices and trends.

Choice of 12.47 kv for co-op primaries was made 20 years ago when nothing less than 7.2 kv phase-to-ground offered hope of serving the scattered farms. But the fact that only one co-op reports changing to 24.9 kv for present practice and only one more contemplates boosting in the future attests to the adequacy of 12.47 and 13.2 kv.

Noteworthy trends in co-op philosophy are a sharp in-

From 12 Individual Rural Cooperatives

E. So. Cent.; . . .%; 6	Mountain; 20%; 7	Mountain; 9%; 8	W. So. Cent.; 10%; 9	W. So. Cent.; 14%; 10	W. So. Cent.; 8%; 11	So. Atl.; 18%; 12
13.2 Ygnd; No 1/0 Cu; 1,500 . . .; . . . Bare; **Cu 90, Cwd 10** .	**24.9** Ygnd; Joint **1/0** eq ACSR; **2,800** Appear; Non-met. Bare; **ACSR 75, Cu 20, Cwd 5** H	12.47 Ygnd; Joint 6 Cu; 500 Not; None Bare; Cu 100 R, H	13.2 Ygnd; Joint **2** eq ACSR; **1,000** . . .; . . . Bare; **ACSR 90, Cu 10** H	13.2 Ygnd; Joint . . . ACSR; . . . . . .; . . . Bare; **ACSR 80, Cu 10, Cwd 10** R, H	12.5 Ygnd; Joint 2 eq ACSR; **500** Not; None Bare; **ACSR 75, Cwd 20, Cu 5** D, H	12.47 Ygnd; Joint‼ **2** eq **ACSR; 1,000** Not; None Bare; **ACSR 50, Cwd 50** D, H
10 to 100 (10) Int. bkr; 125S, 150W Repl. taf. . . .; No . . .	**15 to 100 (15)** Conv; 100S, 125W Repl. taf. No; **Yes** **75 to 150** (. . .)	**5 to 50 (5)** Conv; 100S, 125W Repl. taf., cut spacing Yes; No None	**5 to 25** (5) Int. bkr; 135S, 135W Repl. taf., cut spacing No; No None	**7½ to 75 (10)** Int. bkr; **125S, 125W** Repl. taf., cut spacing . . .; No None	**5 to 167** (5) Conv; **110S, 120W** Repl. taf., cut spacing Yes; No . . .	3 to 167 (5) Conv; 125S, 150W Repl. taf. Yes; No None
4 bare; Cu 100 No; No; . . . **5**; . . . 100W	**1/0** eq bare, cov'd; Cu 90, Al 10 No; No; **50** **4** eq; Cu 90, Al 10 80W	**4** bare; Cu 100 No; No; **4** **6** eq; **Al 50, Cu 50** **50W, 5P**	**4** eq bare; **ACSR 50** No; No; 2 . . .; **Al 50, ACSR 50** **95W, 5P**	**6** eq bare; **ACSR 55, Cu 30, Cwd 15** No; No; **6** eq; **Al 50, Cu 50** 100W	6 eq bare; **ACSR 85,** Cu 10, **Cwd 5** No; No; 1 8 eq; **Cu 80, Al 20** 95W, 5P	**4** eq bare; **ACSR 50, Cwd 50** No; No; 0 6 eq; **Cu 75, Al 25** **98W, 2P**
100F **2,000** **44** 100S, 125W 150S, 150W 400; 2 100W	**100U** **10,000** 69 100S, 120W 120S, 150W 25; 3 100W	**100U** 167 to 500 (1ph) 50 100S, **125W** 150S, 150W **200**; 2 to 4 100W	100F **1,500** . . . 100S, 100W 125S, 125W **400**; **3** 100W	100U **1,000** . . . **125S, 130W** 160S, 190W . . .; **8** 100W	**15F, 85U** 1,500 to 3,000 24.9 100S, 110W 125S, 135W **325**; **4** 100W	100U 500 (1ph) . . . 100S, 100W 150S, 150W **218**; 2 100W
. . .; . . . **R 25**; **P 30**; S	No; **30** **R 30**; **P 30**; **S 25** **10**; **V 25**	No; None R 25; **P 50**; S 5 **50**; **V 50**	No; . . . **R 10**; **P 25**; S 0	. . .; No R . . .; P . . .; S 0	No; None **R 10**; P 10; S . . . 100; None	No; None **R 40**; **P 20**; S 0 100; None
. . . R, S, L Manual; Nothing	**60 min/yr** F, R, S, L Automat.; Nothing	**180 min/yr** **R, S** Man., **auto.**; Nothing	**120 min/yr** F, R, S Man., auto.; Ties	. . . F, R, S . .; Nothing	None **F, R, S** Manual; **Ties**	300 min/yr R, S None; **Ties**

Distribution for Tomorrow's Loads

13.2 Ygnd; No 1/0 Cu; 1,500 . . .; . . . Bare; **Cu 85, Cwd 15** .	**12.48** Ygnd; Joint **5**Cu; **900** Appear; Non-met. Bare; **Cu 55, ACSR 35, Cwd 10** **D, R,** H	12.47 Ygnd; Joint 6 Cu; 500 Not; None Bare; Cu 100 R, H	13.2 Ygnd; Joint **6** eq ACSR; **500** . . .; . . . Bare; **ACSR 85, Cu 15** H	13.2 Ygnd; Joint . . ACSR; 2,499 . . .; . . . Bare; **ACSR 85, Cwd 20, Cu 15** D	12.5 Ygnd; Joint 2 eq ACSR; **250** Not; . . . Bare; **ACSR 80, Cwd 30, Cu 10** D, H	12.47 Ygnd; Joint **6A Cwd, 600** Not; None Bare; **Cwd 90, ACSR 10** D, H
5 to 50 (5) Int. bkr; 125S, 150W Repl. taf. . . .; No . . .	**3 to 50 (10)** Conv; 100S, 125W Repl. taf. No; **No** **15 to 75** (. . .)	**1½ to 50 (5)** Conv; 125S, 150W Repl. taf., cut spacing Yes; No None	**3 to 10 (3)** Int. bkr; 135S, 135W Repl. taf., cut spacing Yes; No None	**1½ to 75 (5)** Int. bkr; **100S, 110W** Repl. taf., cut spacing . . .; No None	**5 to 150** (5) Conv; **120S, 130W** Repl. taf., cut spacing Yes; No . . .	3 to 167 (3) Conv; 125S, 150W Repl. taf. Yes; No None
6 bare; Cu 100 No; No; . . **8**; . . . 100W	2 eq bare; cov'd; Cu 90, Al 10 No; No; **33.5** **6** eq; Cu 90, Al 10 80W	**6** bare; Cu 100 No; No; 2 **8; Cu 100** **100W**	**6** eq bare; **ACSR 85, Cu 15** No; No; **1** . . .; **Cu 70, Al 30** **100W**	**8** eq cov'd; **ACSR 50, Cu 25, Cwd 25** No; No; . . . **8; Cu 100** 100W	**6** eq bare; **ACSR 60, Cwd 30,** Cu 10 No; No; 1 8 eq; **Cu 95, Al 5** 95W, 5P	**6** eq bare; **Cwd 90, ACSR 10** No; No; 0 6 eq; **Cu 95, Al 5** **99W, 1P**
100F **1,500** **44** 100S, 125W 150S, 150W 400; 2 100W	**25F, 75U** **6,000** **44, 69** 100S, 120W 120S, 150W 25; 3 100W	**67F, 33U** 150 to 500 50 100S, 125W 150S, 150W **250**; 2 to 4 100W	100F **1,000** . . . 100S, 100W 125S, 125W **500**; **2** 100W	100U **833** . . . **115S, 125W** 160S, 190W . . .; **5** 100W	**33F, 67U** 1,500 to 3,000 . . . 100S, 110W 125S, 135W **450**; **2** 100W	100U 500 (1ph) . . . 100S, 100W 150S, 150W **250**; 2 100W
. .; . . . **R 0**; **P 0**; S	No; **15** **R 15**; **P 15**; **S 0**	No; None R 25; **P 0**; S . . . **None** **None**	No; 0 **R 0**; **P 6**; S 0 100 None	. . .; 100 R 0; P 0; S 0 None None	No; None **R 30**; P 10; S . . . 100 None	No; None **R 20**; **P 5**; S 0 100 None
None R, S, L Manual; Nothing	**None** F, R, S, L Automat.; Nothing	**None** R Manual; Nothing	**None** F, R, S Man., auto.; Ties	. . . F, R, S . . .; Nothing	None F, R, S Manual; **Nothing**	300 min/yr R, S None; **Nothing**

crease in all forms of supplementary voltage control. Reports imply 220% increase in use of primary capacitors, some with voltage or current control, and 118% increase in pole-mounted regulators. Substation construction is swinging toward unit type of about 2,000 kva but usually without load top changers for bus voltage control.

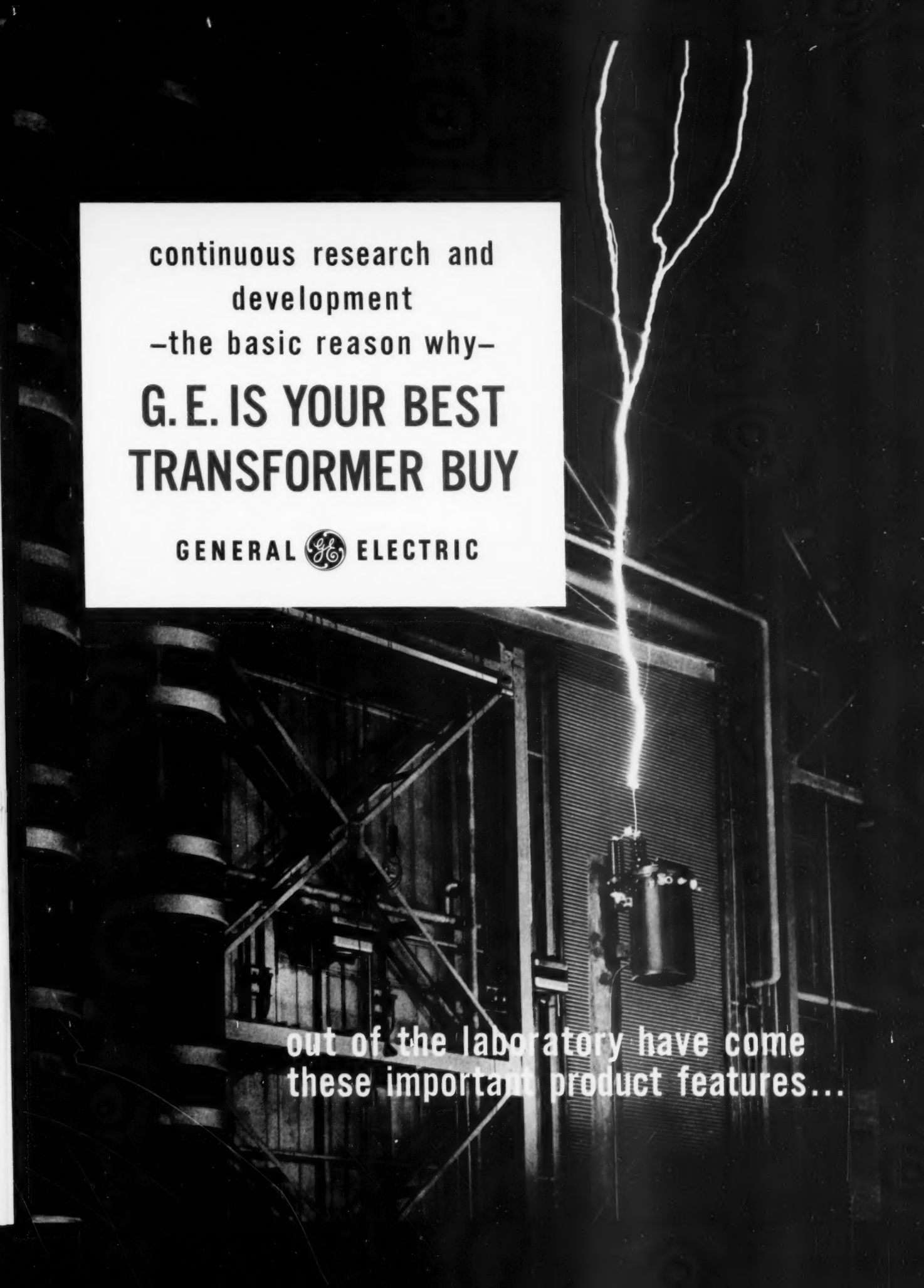
Their use of ACSR for primary conductors, today running over 50%, approaches 65% compared with 45% for the utilities. Secondaries show much the same leaning toward ACSR and aluminum. But copper open wire remains their preference in service drops while utilities swing to preassembled aluminum.

Future Trends in Distribution are Revealed by 5 Co-ops

System location; Load growth; No	So. Atl.; 14%; 13	So. Atl.; 20%; 14	Mid. Atl.; 14%; 15	E. No. Cent.; 19%; 16	Pacific; 10%; 17
PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	12.5 Ygnd; Joint	12 Ygnd; No	12.5 Ygnd; No	12.5 Ygnd; Joint	12.5 Ygnd; Joint
Feeder conductor; Kva rating	2 Cu; 500	2 eq ACSR; **750**	4A & 2 Cwd; 700	2 Cu; . . .	1 eq ACSR; 1,000
Cable req'd by; Type preferred	. . .; . . .	. . .; . . .	Not; None	. . .; . . .	. . .; . . .
Lateral conductor type; Metal, %	Bare; **Cwd 95, Cu 5**	Bare; **ACSR 100**	Bare; **Cwd 95; Cu 5**	. . .; **ACSR 45, Cwd 35, Cu 20**	Bare; **ACSR 100**
Maint. (D)e-energ., (R)ubber, (H)ot stick	D, **H**	D, H	**D**, R	D, H	H
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	5 to **25** (5)	**7½** to **25** (**7½**)	5 to 25 (5)	3 to **15** (**5**)	**10** to **75** (**15**)
Preferred type; Load (S)um., (W)int., %	Int. bkr; Bkr trip	Int. bkr; **135S, 160W**	Int. bkr; 140S, 180W	Int. bkr; 150S, 200W	Conv; 130S, 140W
Overload relieved by	Repl. tsf., cut spacing	Repl. tsf.	Repl. tsf.	Repl. tsf., cut spacing	Repl. tsf.
Taps req'd for voltage; Trend to 3ph	No; No	Yes; No	. . .; No	Yes; No	Yes; No
Ratings purch 3ph (Most common)	None	None	. . .	. . .	None
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	2 bare; **Cwd 97, Cu 3**	4 eq bare; ACSR 100	4 bare, cov'd **Al 50, Cwd 50**	6 eq bare; ACSR 50, Cwd 50	1 eq bare; ACSR 100
Banked; Networked; % 3ph	No; No; 0	No; No; 0.1	No; No; 0.05	No; No; 1	No; No; 0
Min. service size; Metal, %	6; Cu 100	**6** eq; **ACSR 98, Cu 2**	6 eq; **Al 96, Cu 5**	6 eq; Cu 98, Al 2	6; Cu 100
Services, % (W)ire, (C)able, (P)ream.	100W	**2W, 98P**	100W	100W	100W
DISTRIBUTION SUBSTATIONS					
% (F)ield assem.; (I)ndoor, (U)nit	100U	**100U**	**33F, 86U**	100U	**100U**
Transformer bank SC kva	**2,500**	**2,500**	**250** min. (1ph)	500	**3,000**
Subtransmission kv	**44**	**44**	33	69	110
Normal load limit (S)um., (W)int., %	100S, 100W	**135S, 150W**	100S, 100W	125S, 150W	110S, 115W
Emerg. load limit (S)um., (W)int., %	125S, 125W	160S, **200W**	140S, 140W	150S, 200W	. . .
Sq mi/substa.; No. feeders/substa.	**45**; 2 to **4**	**400**; **4**	80; 2 to **3**	25; 2	**300**; **3**
Exits, % (W)ire, (A)erial, (B)uried, (D)uct	100W	100W	100W	100W	100W
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	No; None	No; None	. . .; **100**	No; 100	No; **100**
% Fdrs. with pole-mtd (R)egulators;	**R 10**;	**R 100**;	**R 0**;	**R 25**;	**R 50**;
(P)ri. capac.; (S)ec. capac.	P 0; S 0	**P 100**; S 0	**P 100**; S . . .	. . .	**P 70**; **S 5**
% Primary capacitors—Unswitched;	None	100	**50**	. . .	100
Switch by (T)ime; (V)olt; (A)mp; (O)ther	None	None	**A 50**	. . .	None
SERVICE RELIABILITY					
Criterion	None	None	. . .	60 min/yr	. . .
(F)uses, (R)eclosers, (S)ectionalisers, (L)ine stds.	R, L	R, S, L	R, S, L	R, S, L	R, L
Pickup switching; Feeder plan provides	None; Network	Manual; Ties	Manual; Ties	Manual; Network	**Manual**; Ties

Today's Practices Build Their Distribution for Tomorrow's Loads

PRIMARY CIRCUITS					
Kv ph to ph; Joint with tel.	12.5 Ygnd; Joint	12 Ygnd; No	12.5 Ygnd; No	12.5 Ygnd; Joint	12.5 Ygnd; No
Feeder conductor; Kva rating	2 Cu; 500	2 eq ACSR; **1,000**	6A Cwd; 500	2 Cu; . . .	1 eq ACSR; 1,000
Cable req'd by; Type preferred	Not; None	. . .; . . .	Not; None	. . .; . . .	Not; None
Lateral conductor type; Metal, %	Bare; **Cwd 97, Cu 3**	Bare; **ACSR 97, Cu 3**	Bare; **Cwd 100**	. . .; **ACSR 50, Cwd 40, Cu 10**	Bare; **ACSR 97, Cu 3**
Maint. (D)e-energ.; (R)ubber, (H)ot stick	D	D, H	R	D, H	H
DISTRIBUTION TRANSFORMERS					
Ratings purch 1ph (Most common)	5 to **15** (. . .)	**1½** to **10** (**1½** & **3**)	5 to 25 (5)	3 to **5** (**3**)	**7½** to **50** (**7½**)
Preferred type; Load (S)um., (W)int., %	Int. bkr; Bkr trip	Int. bkr; **200S, 200W**	Int. bkr; 140S, 180W	Int. bkr; 150S, 200W	Conv; 130S, 140W
Overload relieved by	Repl. tsf., cut spacing	Repl. tsf.	Repl. tsf.	Repl. tsf., cut spacing	Repl. tsf.
Taps req'd for voltage; Trend to 3ph	. . .; No	Yes; No	. . .; No	Yes; No	. . .; No
Ratings purch 3ph (Most common)	. . .	None	. . .	. . .	None
SECONDARIES & SERVICE DROPS					
Preferred sec. conductor; Metal, %	**6** bare; **Cwd 99, Cu 1**	**6** eq bare; ACSR 100	**6** bare; cov'd, **Cwd 75, Cu 20, Al 5**	6 eq bare; ACSR 50, Cwd 50	**4** eq bare; ACSR 100
Banked; Network; % 3ph	No; No; 0	No; No; 0	No; No; 0.05	No; No; 1	No; No; 0
Min. service size; Metal, %	6; Cu 100	**8** eq; **Cu 96, ACSR 4**	6 eq; **Cu 95, Al 5**	6 eq; Cu 98, Al 2	6; Cu 100
Services, % (W)ire, (C)able, (P)ream.	100W	**96W, 4P**	100W	100W	100W
DISTRIBUTION SUBSTATIONS					
% (F)ield assem.; (I)ndoor, (U)nit	100U	**75F, 25U**	**67F, 33U**	100U	**100F**
Transformer bank SC kva	**1,000**, **1,500**	**1,500**	**150** to 333 (1ph)	500	**1,500**
Subtransmission kv	**44**	**44**	33	69	110
Normal load limit (S)um., (W)int., %	100S, 100W	**125S, 160W**	100S, 100W	125S, 150W	110S, 115W
Emerg. load limit (S)um., (W)int., %	125S, 125W	160S, **180W**	140S, 140W	150S, 200W	. . .
Sq mi/substa.; No. feeders/substa.	**60**; 2 to **3**	**700**; 2 to 3	80; 2	25; 2	**400**; **2**
Exits, % (W)ire, (A)erial, (B)uried, (D)uct	100W	100W	100W	100W	100W
VOLTAGE REGULATION					
Substa. tap change; % Fdrs. with regulators	No; None	No; None	No; **75**	No; 100	No; **60**
% Fdrs. with pole-mtd. (R)egulators;	**R 5**;	**R 25**;	**R 25**;	**R 10**;	**R 25**;
(P)ri. capac.; (S)ec. capac.	P 0; S 0	**P 25**; S 0	**P 50**; S 0	. . .	**P 30**; **S 0**
% Primary capacitors—Unswitched;	None	100	**100**	. . .	100
Switch by (T)ime; (V)olt; (A)mp; (O)ther	None	None	**None**	. . .	None
SERVICE RELIABILITY					
Criterion	None	None	None	60 min/yr	None
(F)uses, (R)eclosers, (S)ectionalizers, (L)ine stds.	R,L	R, S, L	R, S, L	R, S, L	R, L
Pickup switching; Feeder plan provides	None; Network	Manual; Ties	Manual; Ties	Manual; Network	**Automat.**; Ties


continuous research and
development
–the basic reason why–
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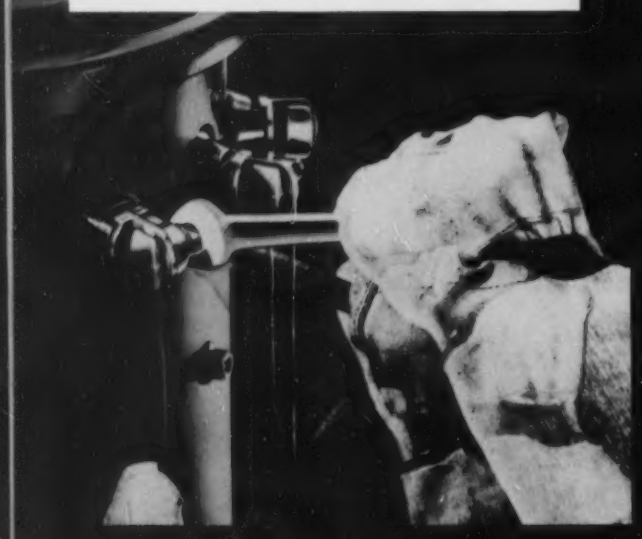
out of the laboratory have come
these important product features...

DISTRIBUTION TRANSFORMERS

Only General Electric offers

Strenicor pressure terminal clamps...

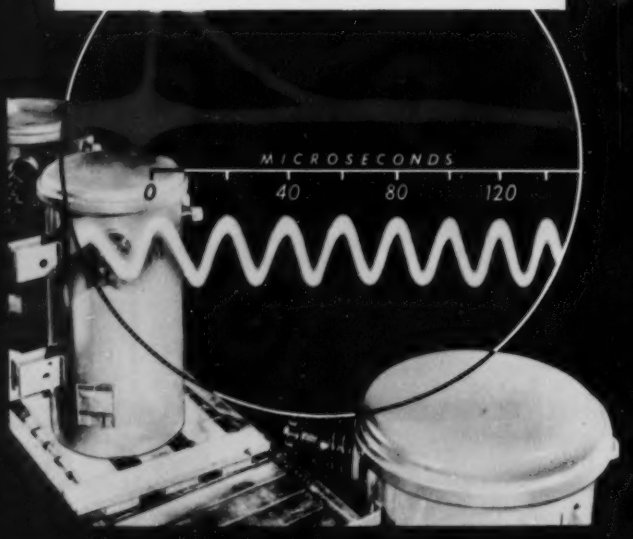
improve service continuity because they resist stress corrosion



General Electric offers

Production-line impulse testing...

assures that you receive only transformers of highest quality



Only General Electric offers

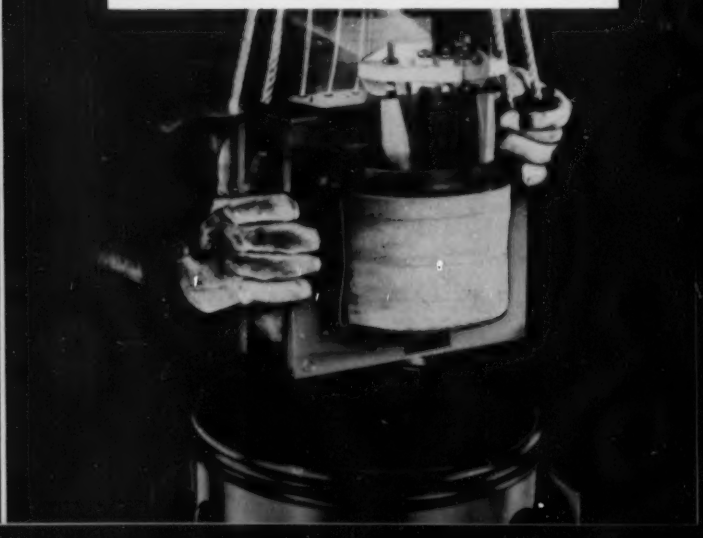
Nitrile rubber gaskets

prolong life of the transformer by sealing out dirt, and by preventing tank breathing

General Electric offers

Nationwide service facilities...

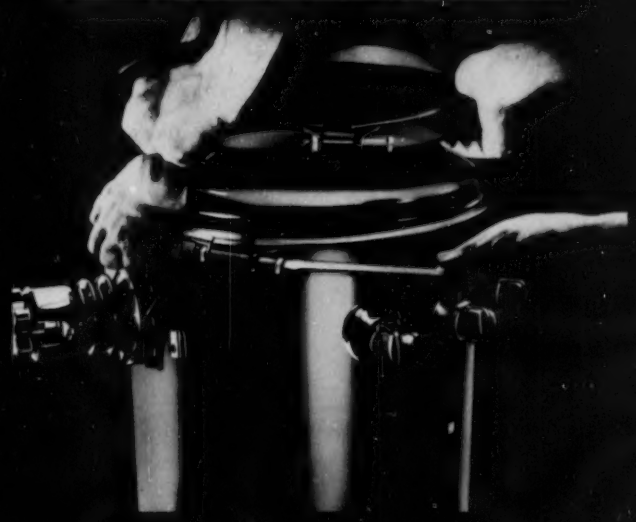
keep your transformers "on the line"



General Electric offers

One-piece cover band...

facilitates inspection... maintains uniform gasket pressure

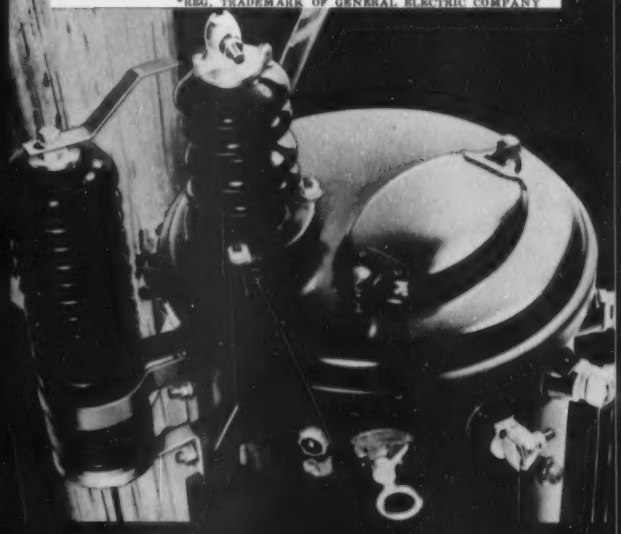


Only General Electric offers

Thyrite* Magne-valve arresters (gapped valve-type)

use them any place on your system regardless of short-circuit currents

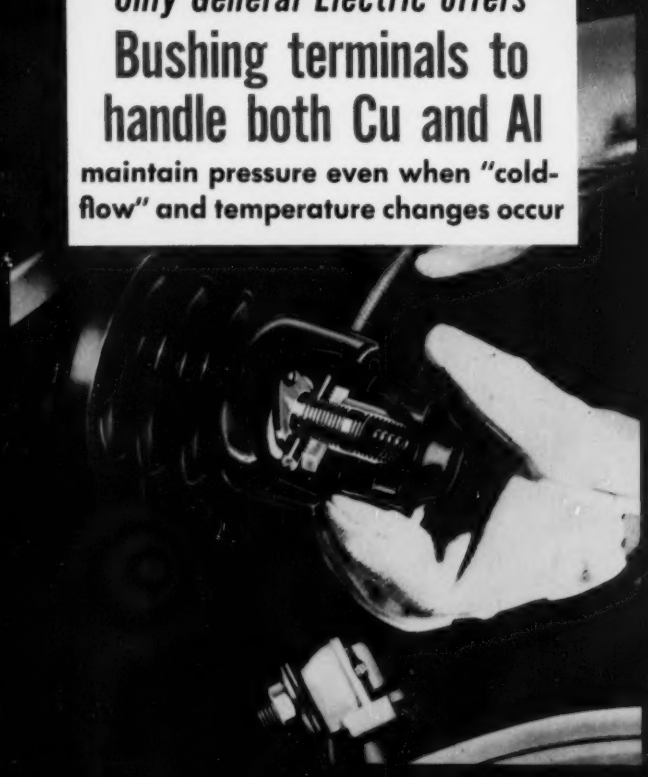
*REG. TRADEMARK OF GENERAL ELECTRIC COMPANY



Only General Electric offers

Bushing terminals to handle both Cu and Al

maintain pressure even when "cold-flow" and temperature changes occur



Only General Electric offers

Super Melaglyp...

a new outdoor finish with up to 150% longer life

ALL TRANSFORMERS ARE NOT ALIKE
FEATURE
GENERAL ELECTRIC
AFR A
AFR B
AFR C
AFR D
AFR E
Strenicor pressure terminal clamps
YES NO NO NO NO NO
Nitrile rubber gaskets at all tank openings
YES NO NO NO NO NO
Gapped valve-type arresters
YES NO NO NO NO NO
Terminals designed for both copper and aluminum conductors
YES NO NO NO NO NO
Production-line impulse testing
YES NO NO YES NO NO
One-piece cover band
YES NO NO NO NO YES
Nationwide company-operated service facilities
YES YES NO NO NO YES

compare the reasons yourself and see why . . .

G.E. IS YOUR BEST TRANSFORMER BUY

1. **STRENICOR PRESSURE TERMINAL CLAMPS** improve service continuity because they resist stress-corrosion. With a high tensile strength of 107,000 psi and a yield strength of 83,000 psi, Strenicor terminals are practically immune to a failure by stress-corrosion. They virtually eliminate outages and resulting service calls and customer inconvenience caused by failure of secondary terminals.

2. **NITRILE RUBBER GASKETS** prolong transformer life because they prevent tank breathing. Used at all tank openings, the gaskets seal out dirt and moisture, thus prolonging the life of the insulation—and of the transformer. The gaskets require no cement, are usable again and again.

3. **THYRITE MAGNE-VALVE ARRESTERS** can be used any place on your system regardless of short-circuit currents. A gapped valve-type design, Thyrite Magne-valve arresters are small, light, and operate without any internal wearing away regardless of system short-circuit capacity or frequency of operation. This assures long service life.

4. **BUSHING TERMINALS** handle both copper and aluminum. Tin-plated to retard corrosion, the bushings maintain tight connections even if "cold-flow" and temperature changes occur. The new terminals handle both aluminum and copper without special fittings.

5. **PRODUCTION-LINE IMPULSE TESTING** assures you of extra years of service from your transformers. This test automatically picks out transformers which have passed all tests prescribed by the American Standards Association but which may still have minor weaknesses. You receive only transformers of the highest quality.

6. **STAINLESS-STEEL ONE-PIECE COVER BAND** prolongs transformer life and facilitates inspection. Exerting even pressure around rim of tank, the band resists corrosion and stays tight even after years of service. With a tight seal, purity of oil is safeguarded. Yet you need only a screwdriver to remove or replace band for maintenance.

7. **NATIONWIDE SERVICE FACILITIES** assure you of fast help when a storm strikes—or when routine repair work piles up. Located at industrial centers from coast to coast, General Electric's 30 service shops are staffed by factory-trained personnel ready to give you fast, emergency service or to handle your routine repair work.

8. **SUPER MELAGLYP** saves you money by greatly reducing your repainting costs. A new paint finish that averages 50% longer life, Super Melaglyp gives you up to 150% more protection than finishes formerly used. General Electric Company, Schenectady 5, New York.

431-20

Progress Is Our Most Important Product

GENERAL ELECTRIC

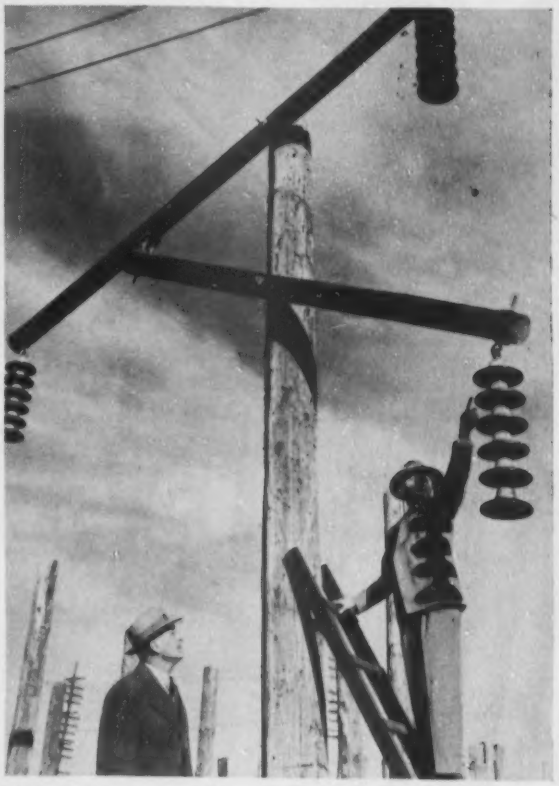
Round Arms for 115 Kv Save up to $500 a Mile

Use of round crossarms on a single-pole, 115-kv transmission line will save $400 to $500 a mile for Portland General Electric Co. At the same time, company engineers believe that the round arms should produce a stronger and safer structure than would standard, square-cut timbers.

Round arms are used in a "wishbone" configuration developed by Louis Neilson and Harry Pearson, who head up PGE's standards office in the engineering department. They estimate savings per pole will run about $25 including the lower cost of the round arms. For PGE, round arms cost about $5 compared with $10 for sawed, square-cut stock of good quality.

The new 115-kv line will carry 795-Mcm ACSR and will require poles 75 to 80 ft high to allow for underbuilt distribution in the future. Contoured gain plates will be used back-to-back to secure the arms to the pole. Insulating gear will be suspended from lower-end eyebolts. The arms will be secured to each other by a contoured, universal connection to provide a balance for load equalization.

When installing arms, PGE recommends that all hardware be tightened until the gain plate prongs are fully embedded in the wood. This should require about 100 ft-lb torque on the ⅝-in. bolts and about 150 ft-lb on the ¾-in. bolts. This torque is well within the allowable stress of the bolts. It is suggested that only new eyebolts and machine bolts be used, rather than material that has been salvaged.



STRONGER STRUCTURE at lower cost is provided by round arms. Lower arm, 12.5-ft long, connects to 15-ft top arm 4 ft 7 in. from latter's end. Distance between bolts securing arms to pole is 4 ft 10 in.

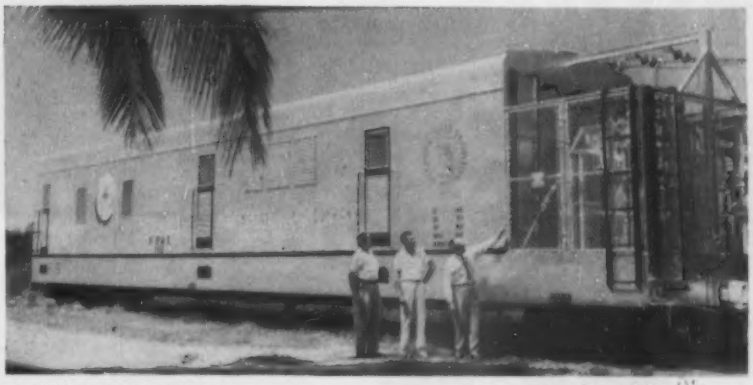
Railway Plants Solve Emergency Service Problem

STEVE R. HARMAN, Florida Power & Light Co, Miami, Fla.

Two company-constructed, 700-kw, 2.4/4.16-kv, diesel driven railway power plants help Florida Power & Light Co solve the emergency service problem.

The primary purpose of the units was for emergency service following hurricane damage and for areas that have been isolated from the system for some other reason. However, when they were put into service in 1951 at Naples, they supplied a load that would otherwise have required immediate construction of a transmission line from the nearest point on the system.

This line is now in service, and the units are used to supply emergency power during brief service interruptions. One unit was even loaned to an industrial firm during interruption of its self-produced electrical power.



RAILWAY POWER PLANT was constructed on former 74-ft long circus train flat car after it was specially reinforced to carry 210,000 lb. Picture shows one of two such units

Each diesel engine is 1,000 hp, 600 rpm, two cycle. It drives a 700-kw, 875-kva, 0.8 pf, 600-rpm generator. The transformers are 750 kva, 2.4-13.2 kv.

About 5 ft of the car's length was set aside for living quarters. In each car there are two hammock type bunks, wash basin and chemical type toilet. A feature of the mobile units

(*Continued on page* 134)

RM POWER TRANSFORMERS

the benefits of ASA standards

RM* brings you all these benefits

Repetitive Manufacture gives you the economy of a standardized product, yet with optional ratings and accessories sufficient to meet most special needs. Ordering is simpler, shipment is many weeks faster, and prices are up to 8% less than those of nonstandard units.

**RM is the G-E designation for ASA-standardized power transformers 69 kv and below; 501 through 5000 kva single-phase, and 10,000 kva three-phase.*

LOWER PRICE

plus . . . . . Superior rust prevention

because Super Melaglyp paint finish lasts up to 150% longer

When you need a transformer in the medium range, order a G-E Repetitive-Manufacture transformer, and you'll get all the benefits of ASA Standards, plus exclusive features that give you better performance, easier handling and less maintenance.

SUPERIOR RUST PREVENTION, for example, is obtained with Super Melaglyp—General Electric's new outdoor paint finish. Lasting up to 150% longer than previous finishes, Super Melaglyp is applied to all transformers manufactured at G.E.'s new Medium Transformer Plant.

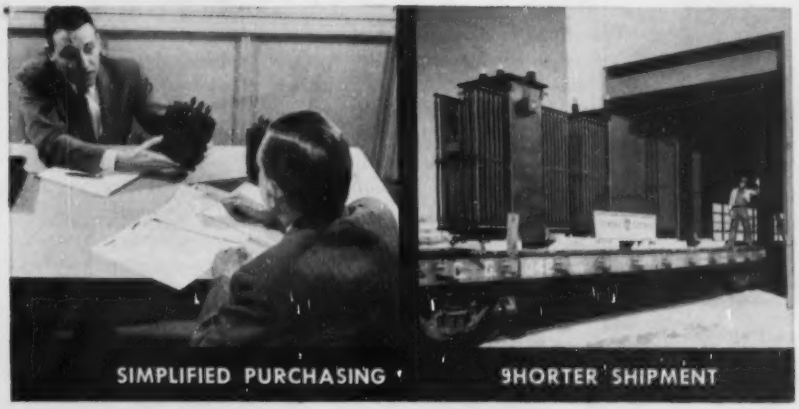
Completed tanks are first cleaned by blasting to remove scale and to prepare the surface for the application of the three-coat paint system. After leak testing, the tanks are given a primer coat pigmented with rust inhibitors to prevent corrosion and two finishing coats of Super Melaglyp. Each coat is thoroughly baked on at 150 C before the next one is applied.

The result is the smoothest, most durable outdoor paint finish obtainable today. It protects equipment better and lasts longer — saving repaintings. Super Melaglyp averages 50% longer life. In salt and chemical atmospheres it has an increased resistance of 75% or more over the previous finish.

MANY OTHER BENEFITS result from the advanced methods and processes used in General Electric's new plant at Rome, Ga. These include high dielectric strength because vapor-phase drying removes entrapped moisture, stronger liquid-tight tanks because submerged-arc welding strengthens major tank joints, and quicker delivery from faster, conveyorized production. Built solely to produce power transformers in the medium range, this plant serves electric utilities and industry by turning out better transformers in shorter time. You can get full information about RM power transformers by contacting your nearest G-E Apparatus Sales Office, or by writing for Bulletin GEA-6108 to General Electric Co., Section 422-12, Schenectady 5, N. Y.

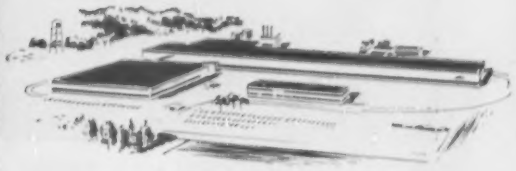
Progress Is Our Most Important Product

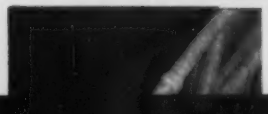
GENERAL ELECTRIC



SIMPLIFIED PURCHASING · SHORTER SHIPMENT

G.E.'s NEW, ROME, GA. TRANSFORMER PLANT—built specifically to meet the growing trend to standardized power transformers.





Power Plants

(*Continued from page* 131)

is the glass jalousie doors.

Each unit cost FP&L $75,000—approximately two-thirds of the market price of ready-made mobile generating units.

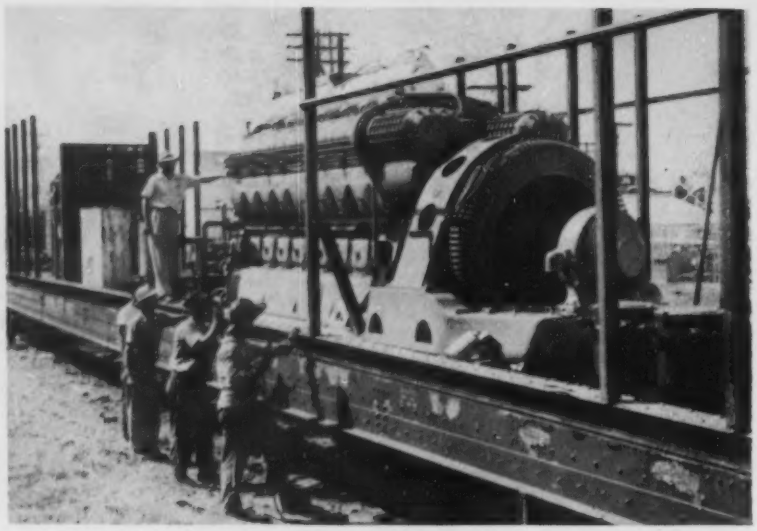
The plants are mounted on special 74-ft former circus train flat cars, which are about twice the length of a standard 40-ft boxcar. They can be moved easily and quickly to any section served by FP&L. The sides are of 11-gauge welded sheet steel.

Cars were reinforced with structural steel to carry approximately 210,000 lb each. Straps were placed under side sills, and bracing was put between the centers and side sills. The cars have double trucks on 63 ft 8 in. centers.

A number of other adaptations and changes were necessary. It was necessary to rewind the generators for 2,400/4,160 v before they could be mounted on the reinforced flat cars. Their voltage was originally 208 v.

Use of batteries for starting the diesel engine was not deemed advisable because of space requirements. Also, there were hazards in transporting liquid-filled cells. In view of this, the electrical starting equipment was removed, and an air motor was located along side the generator. Tanks for compressed air were located beneath the car.

A horizontal fuel tank was located cross-wise of the car on the opposite end from the generators. The tank holds approximately 1,680 gal, or a supply for approximately 1½ days of operation at top capability.



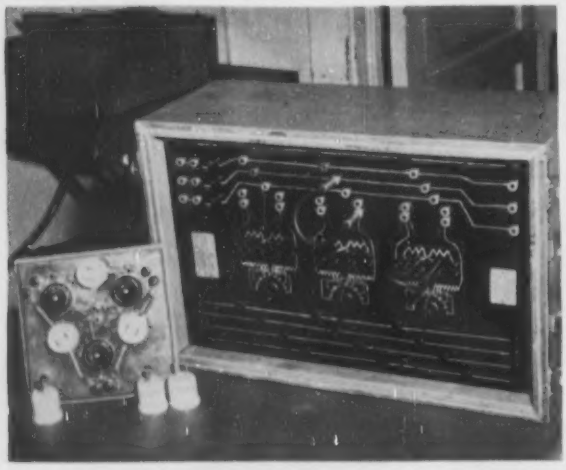
DIESEL-DRIVEN GENERATOR from plant in a Miami office building, which switched to FP&L service, is mounted on flat car. 700-kw generator had to be rewound for 2.4/4.16 kv

Water for the engine is cooled by radiators located in the middle of the car. Air is drawn through three windows located mid-car, carried through the radiators, and out exhaust vents on top. The lubricating oil is cooled by a heat exchanger, introduced into the engine cooling water circuit.

Because these mobile units are sometimes located in or near residential sections, it is necessary to cut noise to a minimum. Noise was reduced by placing a silencer on the exhaust, and employing fiberglass and prefabricated insulation throughout the interior of the cars. To date there have been no complaints of noise.

The top of the car above the engine is removable to permit speedy repairs to the generating units.

Principal designer of the plants was Carl Moore, FP&L engineer, and they were constructed by FP&L personnel under the direction of B. E. McEver, supervisor. The diesel engines were removed from a Miami office building which switched to FP&L service.



TRANSFORMER CONNECTIONS may be illustrated clearly with this plug-in panel. Board at left is for delta or star lamp loads. Flexible wire with banana plugs and jacks are used for connections

Show Connections with Miniature Transformers

W. G. WALSTRA, Assistant Electrical Supt, Southern Division, Idaho Power Co, Twin Falls, Idaho

Transformer connections and effects of load are clearly illustrated to servicemen and linemen of Idaho Power Co with two sets of miniature transformers. Each set is mounted in a case which latches to the other face-to-face for storage and portability.

The transformers are wound for 240/120—240 v with a 100-va capacity. One group of three has end taps for which a mechanical tap changer was designed from meter potential links. The other three have center winding taps to which radio rotary switches are connected to stimulate rotary tap changers. The transformers were wound in the Boise shop for installation in cases built by the author.

A front panel on each case has a schematic diagram

(*Continued on page* 138)

WATCH IT BEING INSTALLED

Two big General Electric power transformers recently made news and you can watch them making it in the 23-minute, G-E color movie, *Power in Place.*

This documentary film shows the whole installation process in clear detail, from sliding the transformer off the flatcar to the assembly of bushings and accessories. Everyone who installs transformers—or would like to see it done—can gain some helpful ideas by watching the installation of a 145,000-KVA unit at the Oak Creek Station of Wisconsin Electric Power Company, and a 135,000-KVA unit at the Delta Station of the Mississippi Power and Light Company. For full information about this educational G-E film, just contact your nearest G-E Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y.

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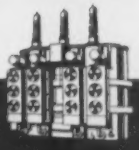
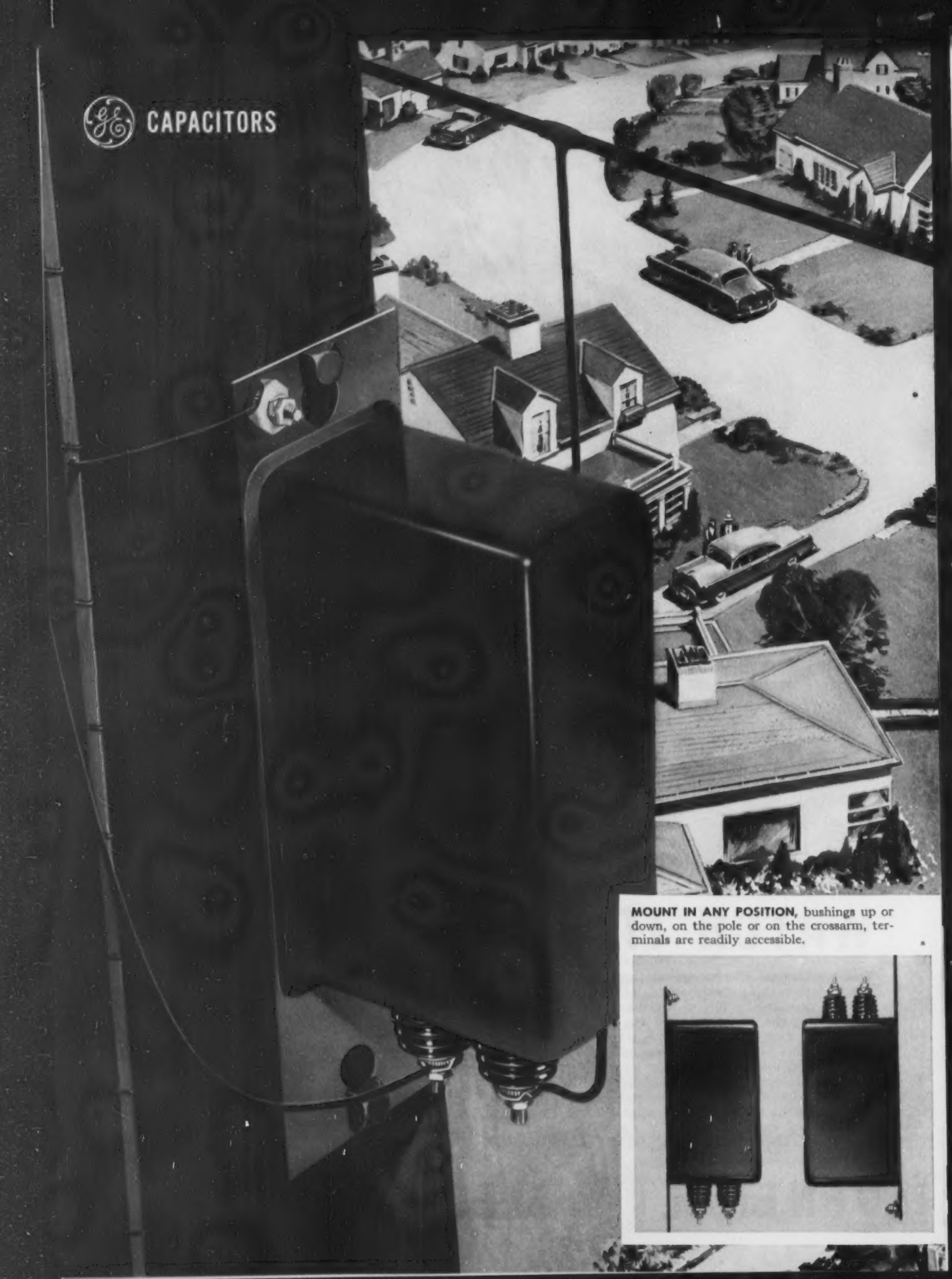
Progress Is Our Most Important Product

GENERAL ELECTRIC



Power Transformer NEWS

CAPACITORS



MOUNT IN ANY POSITION, bushings up or down, on the pole or on the crossarm, terminals are readily accessible.

Now G.E. offers a

5-KVAR RESIDENTIAL SECONDARY CAPACITOR

New unit provides more kvar at lower cost to meet increasing demands of low power-factor residential loads

The trend toward larger distribution transformers and lower residential power factors has led General Electric to develop a 5-kvar 240-volt residential secondary capacitor to supplement its widely accepted 3-kvar units. This new unit provides all the benefits of the 3-kvar unit: improved voltage, reduced losses, and released capacity—and does it at lower cost.

One can be used in place of two

One of the new 5-kvar capacitors can in general be substituted for two 3-kvar units, as shown in the following application table:

Distribution Transformer Capacity, KVA	Suggested Number of Capacitors	
	3-kvar	5-kvar
15	2	1
25	4	2
37.5	6	4
50	8	4

And when you install only one unit in place of two, the economic advantages of the G-E 5-kvar capacitor are readily apparent.

Easily installed near the load

Like the 3-kvar, the new 5-kvar units are designed for direct pole mounting, but may also be mounted on crossarms or on brackets extending out from the pole. They can be mounted with bushings either up or down. A separate ground stud is provided to simplify grounding connections.

The unit is completely evacuated, filled with Pyranol* dielectric, and hermetically sealed. The case is made of drawn steel with rounded corners. These new units are now available for stock shipments.

You can get full information on the new G-E 5-kvar residential secondary capacitor by contacting your G-E Apparatus Sales Representative or by writing General Electric Company, Section 441-9, Schenectady 5, New York.

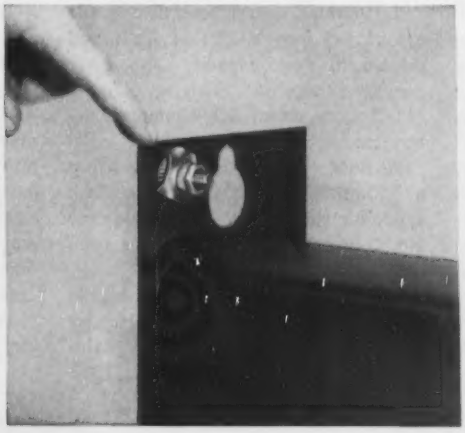
*Reg. trademark of General Electric Company.

Progress is our most important product

GENERAL ELECTRIC

SUPER MELAGLYP, a new outdoor finish that averages up to 50% longer life in all types of atmospheres.

SEPARATE GROUND STUD, now on both the three and five-kvar units, is easily reached, simplifies grounding connections.



SHIPMENT FROM STOCK can now be made from factory and warehouses. Check with your G-E Sales engineer.

Transformer Connections

(*Continued from page* 134)

of transformer windings and connections, together with four-wire primary and secondary buses. The primary bus is fused with instrument fuses. All external connections are made with flexible hookup wire supplied with "banana" plugs and jacks.

A group of plug-in sockets on another board permit lamp loads to be changed quickly from delta to star connections. The three-phase winding of a selsyn transmitter is used as an induction motor. Its load represents almost 100 va.

With the help of a voltameter, 1-5-amp ammeter, and phase-angle meter, results of loading open-delta banks, single-phase operation of three-phase motors and power factor correction may be shown. Effect of brake-loading an induction motor shows what happens to load current and phase angle. Such problems as use of zig-zag grounding transformers and sympathetic tripping of distribution feeders have been discussed.

Most of the problems involve a wye primary, but all sources available in class rooms are 230-v delta. Therefore, one group of transformers is normally considered a delta-wye substation bank furnishing a 416-v wye, 3-phase source for the other transformers.

New Method Rapidly Determines Sulphur in Gas

Determination of the percent by volume of sulphur dioxide and sulphur trioxide in flue gas can be made in about one hour after collection of sample with apparatus developed for field use by Babcock & Wilcox Co. Only one standard solution is used which can be kept indefinitely without appreciable change in strength.

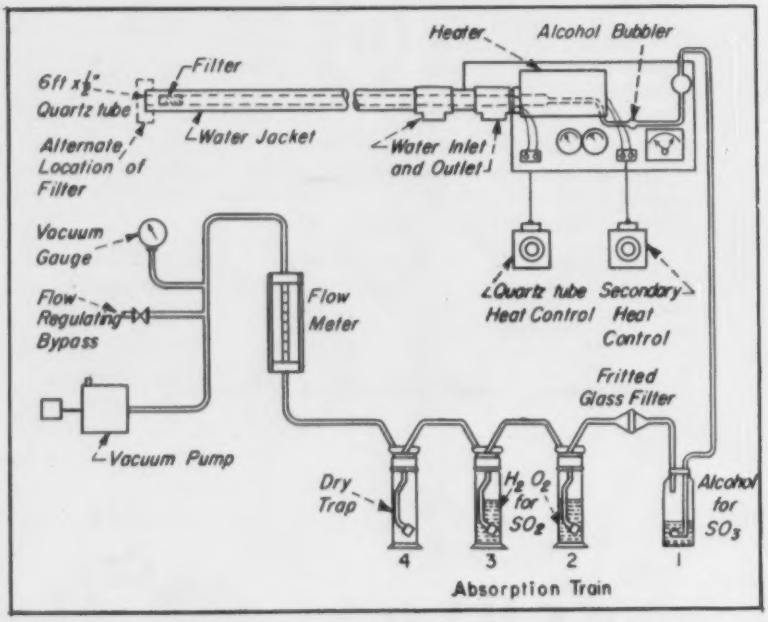
Gas sample is collected by a 6-ft long, ½-in. ID, quartz tube having a heating wire along its full length and encased in a water-cooled steel pipe. Heater and cooler hold the sample temperature at about 650F to prevent condensation and oxidation.

Flyash is removed by passing the gas through a filter held about 2 in. inside the inlet of the tube with a resistance-wire basket. At higher temperatures the filter is placed over the inlet end of the tube.

Clean gas passes from the tube into a bubbler containing 80% isopropyl alcohol to inhibit oxidation of SO_2 to SO_3. Inlet of bubbler is heated to approximately 400F to prevent condensation. Gas then passes through an absorption train consisting of four bottles.

First bottle contains additional isopropyl alcohol for complete absorption of SO_3 and is followed by a fritted glass filter to trap any sulphuric acid mist that might escape. Next, there are two bottles containing 3% hydrogen peroxide and distilled water, in proportions of one to two, for SO_2 absorption. Bottle four is dry and protects the flow meter from possible mechanical carryover of peroxide solution.

Gas is drawn through the system by a vacuum pump at a rate of one liter per min during sampling. One hour is the normal sampling time.



SAMPLING EQUIPMENT is arranged in a portable case that protects absorption train glassware. Rate of gas sample flow is accurately controlled by flow by-pass valve

At the end of the test the following operations are performed:

1. Bubbler, filter, and first bottle are rinsed into a 250-ml flask and diluted to flask capacity with 80% isopropyl alcohol. This is sample No. 1 from which SO_3 content is determined.

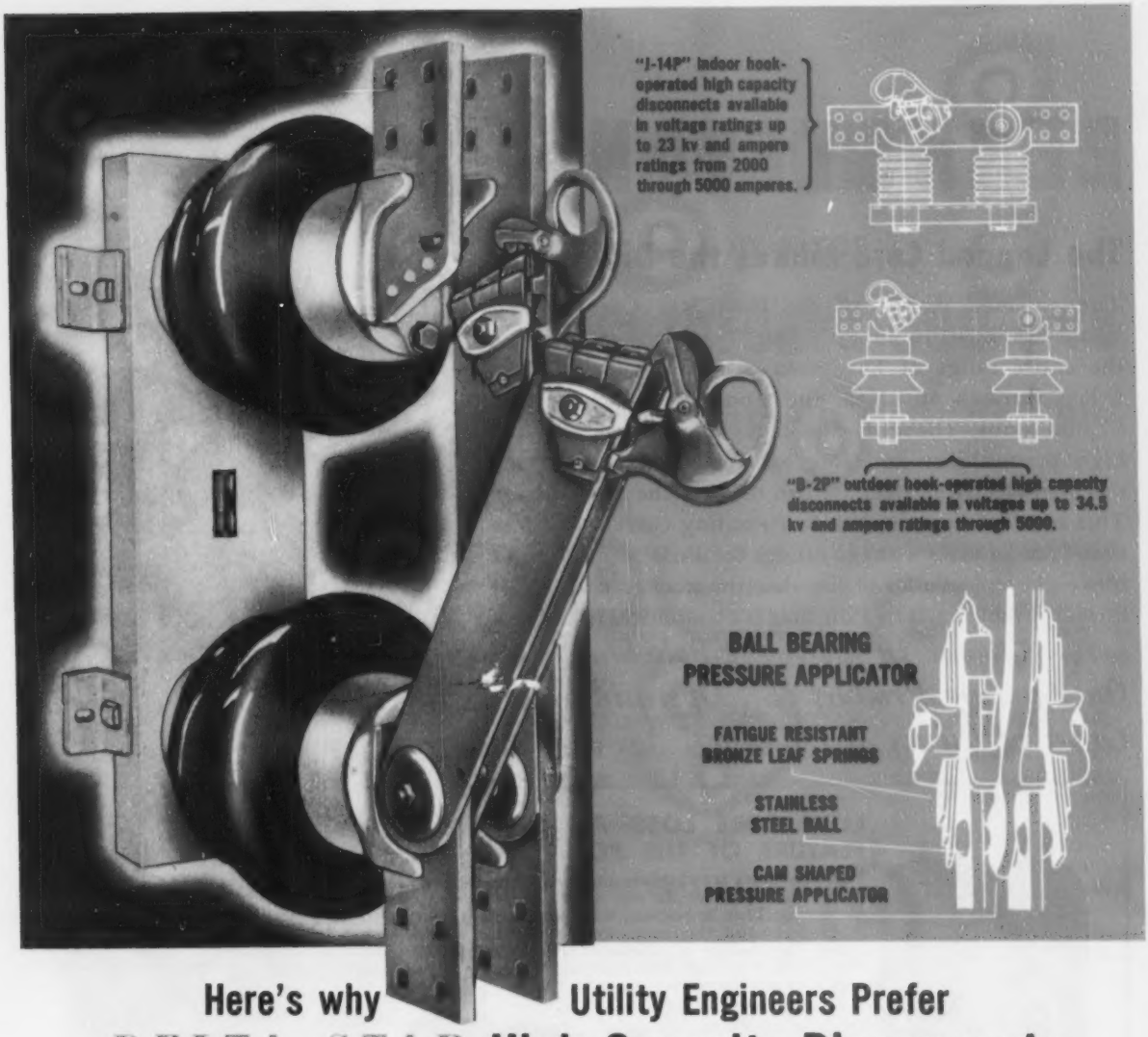
2. Bottles 2 and 3 are rinsed into a 250-ml flask and diluted to flask capacity with water. This is sample No. 2 and is used to determine total sulphur.

To determine SO_2, 45 ml of sample No. 1 are placed in a 50-ml Nessler tube. Five ml of solution A containing 72% isopropyl alcohol, 18% water, and 10% concentrated hydrochloric acid (all by volume) is added and shaken well. One ml of solution B consisting of 20% barium chloride solution is added. Solution is shaken well for 30 sec and then allowed to stand for 5 min.

Rate of addition of barium chloride must be controlled and is established by rate used when making calibration curve for turbidimeter. Curve was established on rate of 1 ml in 7½ sec. Any deviation from this rate will give high or low readings when using curve.

The blank is prepared from 45 ml of the sample, 5 ml of solution A and

(*Continued on page* 146)


"J-14P" indoor hook-operated high capacity disconnects available in voltage ratings up to 23 kv and ampere ratings from 2000 through 5000 amperes.
"B-2P" outdoor hook-operated high capacity disconnects available in voltages up to 34.5 kv and ampere ratings through 5000.
BALL BEARING PRESSURE APPLICATOR
FATIGUE RESISTANT BRONZE LEAF SPRINGS
STAINLESS STEEL BALL
CAM SHAPED PRESSURE APPLICATOR

Here's why Utility Engineers Prefer DELTA-STAR High Capacity Disconnects

Exclusive ball pressure applicator and blade lock mechanism which applies contact pressure after blade is in fully closed position, and releases contact pressure before blade is opened. Hook-ring operated, this device makes operation of a 5,000-ampere disconnect as easy as one rated 400 amperes.

Straight line current path so essential in high capacity disconnects, minimizes number of current interchange surfaces and avoids danger of "blow-out" force on switch blade under short circuit conditions.

All current carrying parts are of **hard drawn copper** assuring lowest possible temperature rise.

Heavy silver inlayed contacts backed by silicon bronze pressure springs provide efficient low resistance, high pressure contacts.

DELTA-STAR Heavy Duty Disconnects meet your most exacting specifications for long, efficient, trouble-free service. Specify DELTA-STAR B-2P Disconnects for your next outdoor installation or J-14P for indoor service.

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
OF PITTSBURGH
2437 Fulton Street • Chicago 12, Illinois
District Offices in Principal Cities

PENNSYLVANIA Pole

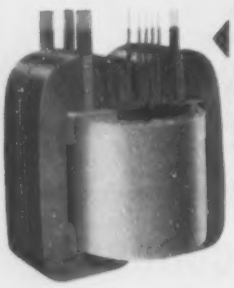
The Lapped Core Makes the Difference

The patented design of the Pole Star Core enables Pennsylvania to build Pole Star Transformers through the entire range of EEI-Nema distribution sizes, from 3 Kva through 500 Kva, and from 480 Volts through 67,000 Volts. The Pole Star takes full advantage of the high permeability and low loss characteristics of the oriented electrical steel used in making the lapped core. This results in a core with low exciting current and low core loss. In every voltage rating, the Pole Star is lighter in weight and smaller in size than the stacked core transformer it replaces. The Pole Star is economical to operate and easy to install. *In short, the Pole Star is an Outstanding Product . . . Operating with Great Efficiency at Low Cost.*

pt

PENNSYLVANIA POLE STAR TRANSFORMER

100 Kva

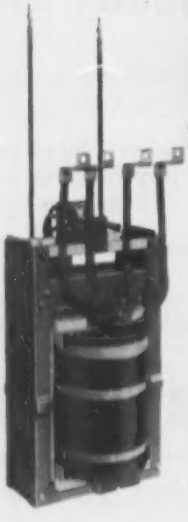


LOW CORE LOSS—AN OUTSTANDING FEATURE OF THE POLE STAR

Pole Star cores are carefully annealed in controlled-atmosphere furnaces, but do not suffer the disadvantages of adhesions. That is because when the core is assembled through the coil, the laminations are separated from each other. The absence of adhesions between laminations and the presence of high interlamination resistance keep the core loss at a low value.

INTERNAL ASSEMBLY OF 167 KVA POLE STAR

Side frames completely enclose the core and provide a sturdy support for the entire unit. The Pole Star coil is designed for a low temperature gradient and a high overload capacity. Large oil ducts are provided in the coil to permit a free flow of oil through the coil. High voltage and low voltage windings are properly balanced to minimize the effects of short circuits.



NEW BASE FEATURES CROSS VENTILATION

Structural steel bars are welded to the tank bottom. Their arrangement permits the transformer to be rolled in any direction. Jack lugs extend beyond the tubes or radiators. Openings provide cross ventilation for the tank bottom and the base. The entire tank bottom is accessible through the openings for painting.

CORE BUILDER ASSEMBLES LAMINATIONS THROUGH 500 KVA POLE STAR COIL

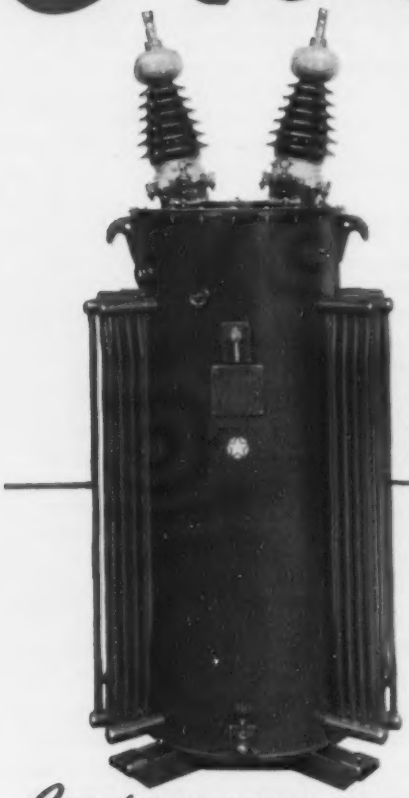
Core laminations are individually lapped. There are no gaps or butt joints in the Pole Star core to cancel out the advantages of the cold-reduced, oriented electrical steel. The lapped construction reduces the flux density at the joint and maintains the low reluctance path of the Pole Star core.

Star TRANSFORMERS

in sizes

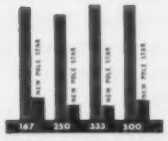
3 Kva through 500 Kva

480 Volts through 67,000 Volts

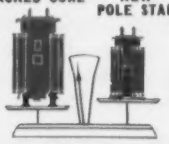


500 Kva

Compare THE NEW 500 Kva POLE STAR WITH THE OLD 500 Kva STACKED CORE TRANSFORMER



EXCITING CURRENT REDUCED 75%

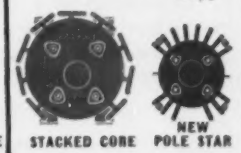


WEIGHT REDUCED 2200 POUNDS

OIL VOLUME REDUCED 35% (125 GALLONS)

NEW POLE STAR — STACKED CORE

FLOOR AREA REDUCED 20%



STACKED CORE — NEW POLE STAR

1 YOU WILL GET BETTER PERFORMANCE *Because* Pole Star transformers have a reduced core loss and therefore operate at higher efficiency. The Pole Star core uses to best advantage the superior magnetic qualities of cold-reduced oriented electrical silicon steel.

2 YOU WILL GET BETTER VOLTAGE REGULATION *Because* Impedances have been reduced. Better customer relations will result since lower impedances mean less voltage fluctuation during load changes, and less voltage drop during peak loads.

3 YOU WILL SAVE MONEY *Because* Pole Star transformers have lower exciting current — *the current needed to magnetize or excite the core.* Since it is always present — under *any load* or *no load* conditions — a certain amount of generating Kva must be earmarked for exciting current and nothing else. In terms of hundreds of transformers, this generating Kva can mount up to large amounts of generating capacity, supplying nothing but exciting current and returning no revenue to the utility.

It is good business, therefore, to install Pole Star transformers on *your* lines. Under *no load,* less generating capacity would be required. At *full load,* the utility will derive more output per unit of generating capacity. By installing Pole Star transformers with low exciting current, real dollar savings can be achieved.

4 YOU WILL BE USING SMALLER TRANSFORMERS *Because* Pole Star transformers from 167 Kva through 500 Kva are as much as 28% lighter and 30% smaller in size. This means you will get *more Kva per pound* when you install Pole Star transformers on your lines. It further means that when you must replace your old transformers because of heavier loads, you can install larger Kva-rated Pole Stars with little or no increase in size or weight.

PENNSYLVANIA
TRANSFORMER COMPANY

A McGraw Electric Company Division

CANONSBURG, PA. • *Greater Pittsburgh District*

How to Maintain Live-Line Tools

Ten suggestions are outlined to prolong the life and usefulness of "hot-sticks"

O. G. ANDERSON, Field Engineer, A. B. Chance Co, Centralia, Missouri

Protective maintenance will not only make live-line tools last longer but will give the linemen safer tools with which to work and more confidence in using them.

Dry Tools . . . An important point in care and use of hot-line tools is to keep them dry. Tools may be leaned against a fence or a truck or kept in a trailer if close enough to the job. Tools should not be laid on the ground, but may be laid on a clean tarpaulin.

Insulated tools subjected to direct contact with water should be dried as soon as possible and hung vertically in a drying room or a cabinet. A drying cabinet is easily made. A bank of incandescent lamps will provide adequate heat, and openings in the top and bottom of the cabinet will provide air circulation. A thermostat will maintain a fairly uniform proper temperature, between 90 and 100 F. Bars or hooks across the top of the cabinet will support the tools in a vertical position.

Low Wood Moisture . . . Stick surface may be kept dry and the finish may be in excellent condition, but this is no guarantee that the wood has not absorbed excessive moisture from the air. Tests show that varnish, paraffin, oil, and special moisture resistance preparations will not prevent a wood member from absorbing sufficient moisture to affect or reduce its insulation characteristics. During periods of higher humidity, extra precaution may be required.

Usually tools not in use will maintain adequate insulation strength when kept indoors at normal room temperatures. Periodic treatment in a drying cabinet for 48 hr, or for one week per month, is recommended in moderate climates.

Clean Tools . . . Wood members particularly should be kept clean to permit proper inspection of the finish. Some companies require ground men to wipe each wooden member with a cloth before the tool is sent up to the linemen. To prevent dirt or moisture working into the wood fibers and forming dangerous conductor paths, prompt touching up is recommended where the finish is worn or scraped.

Maintain Finish . . . Before applying a new finish, the old varnish and dirt must be scraped off. No. 6/0 sandpaper is about the best for smoothing the sticks. Then the poles should be placed in a drying cabinet for at least 48 hr. Three coats of pole preservative are suggested for the varnished tools after they have been dried out. Maplac coated sticks should be dried out also before patching the Maplac coating. Note: Moisture can be sealed in a stick as well as it can be sealed out.

Transportation . . . Containers should be provided to prevent damage to the surface of the sticks. Individual covers may be made of waterproof canvas or discarded fire hose. Many companies use special trailers with built-in racks for hot-sticks. These racks should be well padded and hold the tools firmly so they will not be damaged because of vibration. Trailers are furnished with electric heaters and thus do double duty as a storage cabinet when not on the job.

Inspection . . . Hot-line tools should be inspected regularly. Look for indications that a tool has been overstressed. Such indications include bent or cracked parts, bent rivets or bolts, signs that ferrules have pulled away from their original position, and damaged wood members. Also check for excessive wear.

Damaged Tools . . . A damaged tool should never be placed in service. Excessive strain will overstress the part and weaken it. This will cause the tool to fail at a lesser load at a later date. If a doubt exists about the condition of the tool or part, test it before using it.

Broken Poles . . . Repair of a broken pole is not advisable. Such a pole can be repaired, but the process is exacting, requiring considerable skill to restore the pole to first class condition. A new pole is safer and more economical.

Cracked Members . . . Welding or brazing of cracked or broken members is not recommended because metal adjacent to the weld may be impaired or heat treatment of the part may be destroyed. If the tool has been overstressed and a part broken, other parts may have been weakened. Such a tool can be dangerous to use and should be discarded or refitted with replacement parts.

Proper Tools . . . Many tools are broken because of improper use. Linemen should use each tool only for its intended purpose and in the approved manner. New equipment should be thoroughly understood before it is placed in service. This applies to a safe mechanical loading as well as its method of operation. Manufacturers ratings of tools should never be exceeded. Linemen must know conductor weights and line tensions.

Ten Points on Maintenance of Tools

1. **Keep live-line tools dry; never use a wet tool**
2. **Keep moisture content of wood low**
3. **Keep tool clean**
4. **Maintain a good finish on wooden member**
5. **Protect tools when transporting them**
6. **Inspect all tools regularly**
7. **Never place a damaged tool in service**
8. **Do not try to repair a broken pole**
9. **Do not try to braze or weld cracked or broken members and metal parts**
10. **Know the proper use for each live-line tool**

Adapted from a paper entitled "Manufacture, Care, and Use of Hot Sticks" presented by the author before a meeting of Pennsylvania Electric Association Transmission and Distribution Committee at Baltimore, Md.

Somastic Serves the Electrical Industry...

OVER 2,000,000 FEET OF HIGH-VOLTAGE CABLE PIPE

SOMASTIC COATED

TO PREVENT EARTH CORROSION AND ELECTROLYSIS

Electrical engineers look upon Somastic as one of the essential factors in the development of a growing network of pipe-type cable systems in the United States. In less than ten years more than two million feet of high-voltage cable pipe—representing 96 per cent of direct earth-burial pipe-type cable systems—have been coated with Somastic by H. C. Price Co. Somastic's seamless coating provides lasting protection for these installations against the ravages of earth corrosion and electrolysis.

Below is a partial list of the users of Somastic coating for protection of high-voltage cable pipe:

UTILITIES

Boston Edison Company
City of Jacksonville, Florida
Consolidated Edison Company
Commonwealth Edison Company
Detroit Edison Company
Duquesne Light Company
Florida Power and Light Company
Memphis Light, Gas & Water Division
Philadelphia Electric Company
Wisconsin Electric Power Company

CABLE MANUFACTURERS

General Cable Corporation
The Okonite Company
Phelps Dodge Corporation

H. C. Price Co. offers the following important services to users of high-voltage cable pipe:

- Grit blasting, cleaning and coating of pipe interior to protect expensive cables
- Special preparation of pipe ends to permit a smooth pull of cable between widely-separated manholes
- Somastic pipe coating for protection against earth corrosion and electrolysis
- Hevicote applications to provide weight and protection to pipe in marine areas
- Also — pipe bending, re-conditioning, welding, hydrostatic testing, hauling and stringing

H. C. Price Co., "America's Foremost Pipeline Constructors," offers a complete cable pipe processing service to the electrical industry. Inquiries are welcome. For further information, write or call

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Phone Orchard 3-8132
P. O. Box 6120

Phone 4700
P. O. Box 1111

Phone, Edison 2281
P. O. Box 263 Harvey, La.

Pouring power into a giant of steel

Dramatic symbol of America's industrial might, U.S. Steel's big Fairless Works is completely new—a giant at birth! From foundations to furnaces, here is an outstanding example of industrial foresight and planning.

Among this huge mill's many impressive innovations is its planned system of power distribution. Substations, switchgear, and circuit breakers—channeling power throughout this giant of steel—are strategically located to provide maximum protection, control, and continuity of service.

Installation of *only the finest* of equipment has been a long tradition at U. S. Steel. Electrical distribution equipment—of fundamental importance—has to be rugged and dependable to fulfill these vital requirements.

at U.S. Steel's new FAIRLESS WORKS

kilowatts for a colossus feed
through switchgear and circuit breakers built by I-T-E

Some 70 modern indoor and outdoor I-T-E Unit Substations transform and distribute power throughout the mill. I-T-E Low-Voltage and Metal-Clad Switchgear, as well as Heavy-Duty I-T-E Circuit Breakers, guard the many critical steel processes.

From the start, I-T-E gave important engineering assistance in the preparation of specifications and in expediting *switchgear* orders for the Fairless Works. As a result of this close cooperation, power distribution equipment was on the ground *when needed* to fit right in with tight construction schedules.

Traditionally a supplier of U. S. Steel, I-T-E is proud of its place as a *major* contributor of quality power distribution equipment for the new Fairless Works.

AT FAIRLESS—

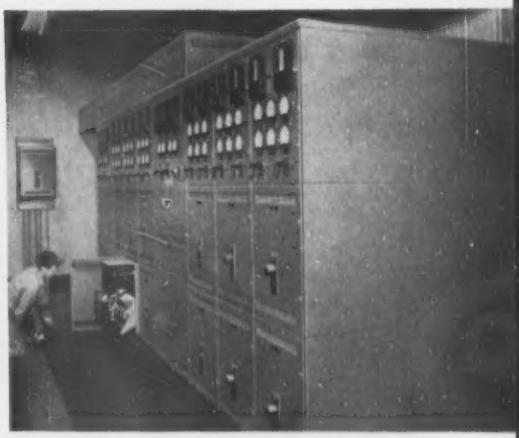
I-T-E Switchgear protects:

rolling mills	**open hearths**
coke ovens	**maintenance shops**
power house auxiliaries	**office building**
billet mills	**car dumper**
strip mill	**ore dock**
blast furnaces	**oil bulk storage**

For details, contact the I-T-E field office nearest you. Look in your classified directory under "Electric Equipment."

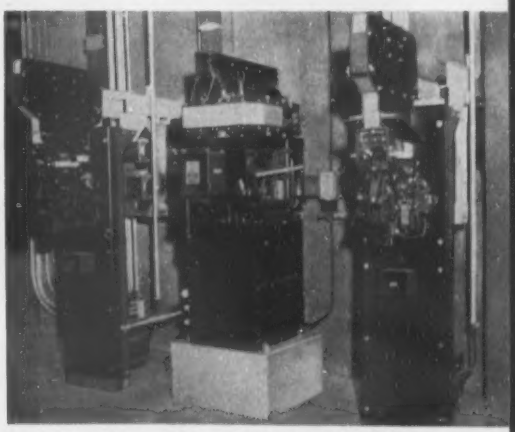
I-T-E METAL-CLAD SWITCHGEAR

installed in cold mill for 2400-volt distribution.



I-T-E LOW-VOLTAGE SWITCHGEAR

installed in sheet and tin mill for 480-volt distribution.



I-T-E HEAVY-DUTY CIRCUIT BREAKERS

Types MT and OH, used for DC sectionalizing in billet mill.

THE SYMBOL OF QUALITY SWITCHGEAR

I-T-E CIRCUIT BREAKER COMPANY

19TH AND HAMILTON STREETS, PHILADELPHIA 30, PA.

SWITCHGEAR PRODUCTS

Determining Sulphur

(*Continued from page* 138)

1 ml of distilled water. This method of preparing blank compensates for any turbidity the sample may have prior to addition of barium chloride.

Blank is used to set the turbidimeter's microammeter at highest reading. The sample is then substituted for the blank and microammeter read again.

SO_2 content is read directly from a calibration curve made by running a series of solutions to which have been added known quantities of standard H_2SO_4 treated with reagents. A standard containing an appropriate amount of N/10 H_2SO_4 should be run with every set of determinations.

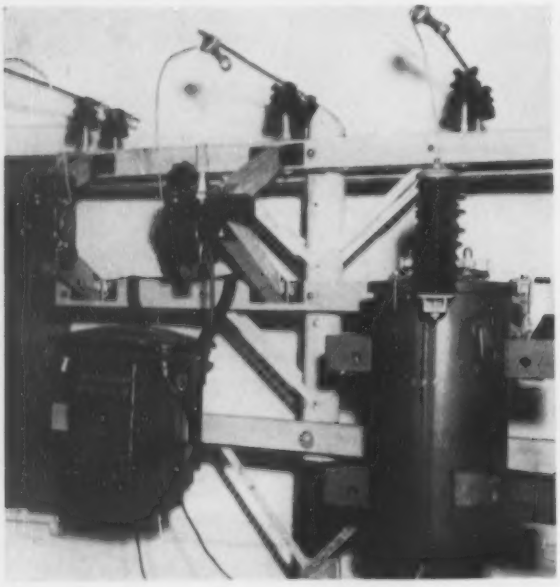
When making standards the volume of standard sulphuric acid used should be deducted for the amount of water added. This will keep quantities of water, isopropyl alcohol, hydrochloric acid, and barium chloride constant for all standards and samples. Thus, the same curve can be used for both SO_2 and total sulphur determination.

Grams of SO_2 can be determined by multiplying the content obtained from the calibration curve times 5.56.

Total sulphur is next determined by placing 5 ml of sample No. 1 and 5 ml of sample No. 2 in a 50-ml Nessler tube. To this is added 32 ml of pure isopropyl alcohol and 3 ml of water. The above procedure is repeated. A blank using 1 ml of distilled water in place of 1 ml of solution B should be made for this determination.

Grams of total sulphur as SO_2 in gas is obtained by multiplying sulphur content from curve times 50. Grams of SO_2 is determined by subtracting grams of SO_2 from grams of total sulphur and multiplying by 0.8.

Condensed from a paper by R. E. Matty and E. K. Diehl, Babcock & Wilcox Co, presented at a meeting of the American Chemical Society in Chicago, Ill.



Transformer Installation Eliminates Hazards

D. E. WIMBERLY, Safety Consultant, Arkansas Missouri Power Co, Blytheville, Ark.

To reduce hazards on the pole the author has developed a transformer installation design which places the secondary leads next to the pole, the primary leads away from the pole. Universal adoption of this design should eliminate many of the 60% to 70% of the lineman fatalities, which statistics show occur on the transformer pole.

The design places transformer hangers on the secondary side of the transformer. This forces cutouts and primary leads out away from the working area where the lineman will not have to reach over or through them in doing most of his work on a transformer pole.

Several installations of this type have been made in the field and a model has been made up to show how the design would work with different types of transformers.

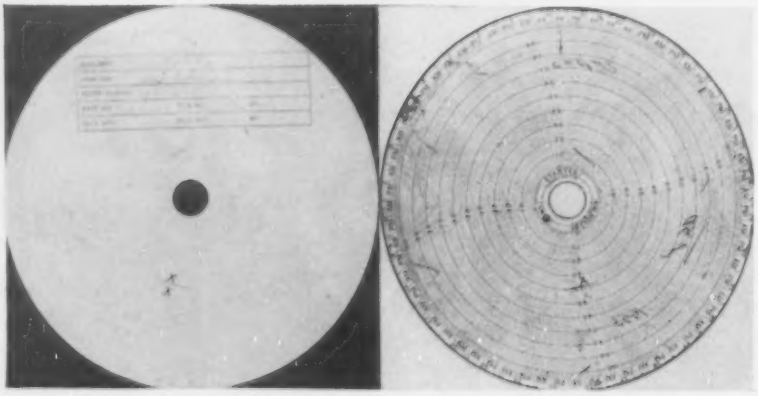
Felt Pad Prevents Defacement of Waxed Charts

W. E. BROOKS, District Meter Superintendent, Appalachian Electric Power Co, Bluefield, W. Va.

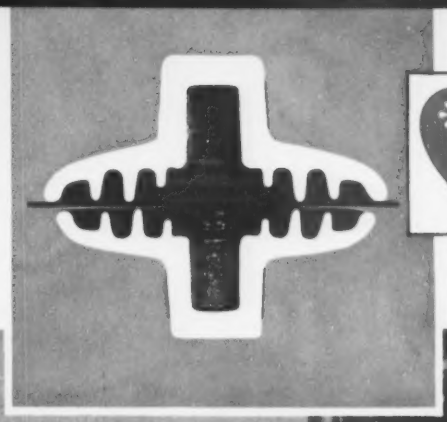
A billiard-cloth pad, on which a waxed chart can be laid before rear-side labeling, prevents defacement of the chart by writing on the reverse side. Because of the type of chart, such as that used for demand meters, sharp impressions or strokes on either the back or face leave black marks on the face. The marks may obscure the record or confuse the person analyzing it.

The pad size is 7¾ x 7¾ x 3/32

(*Continued on page* 151)



WAXED CHART laid reverse side up on billiard-cloth prevents defacement of the face when back is labelled. Face (right) of chart shows marks when precautions were not taken



Above -- Set of sag bars in place on a kiln car. These have traveled through the kiln with the insulators. Different degrees of sag in the bars is the result of intentional variations in ceramic composition to provide normal as well as definite plus and minus indications.

Upper right -- Droop illustrated: Top specimen, un-fired suspension insulator shell, cross-sectioned. Lower specimen, fired shell. These have been separated by a piece of glass, acting as a straight-edge. Note the definite sag in the fired piece. It is also interesting to observe dimensional shrinkage that occurs on firing, amounting to about ten per cent.

Right -- Precision measurement of sag. Bars shown in another photograph are taken to the laboratory where deformation is measured to the thousandth of an inch by means of a dial indicator.

Even the force of gravity helps determine insulator shape

Kiln temperatures are so high that a slight droop occurs in insulators while they are held for hours at the threshold of their fusing point. By proper control of many elements, this action of gravity on heat-softened porcelain becomes an intentional part of the design. But, obviously, it takes close watching!

This is done by using "sag bars." These bars are compounded in the Ceramic Laboratory of slightly varying compositions. They reveal normal behavior as well as plus and minus variations. Sag bars travel through the kiln with the product, after which their deformation is accurately gauged. They indicate far more precisely than mere visual inspection of an insulator whether anticipated droop is fully under control.

Remember, you cannot truly connect the word "design" with the insulator you buy -- it is only the *reproduction* of a design. Hence, the importance we attach to consistent manufacture. Only exact reproduction can assure maximum exploitation of good basic engineering.

Is such special care a part of common insulator manufacturing practice? Does it show in the finished piece? Is it required by industry standards? The answer is "no" on all three counts. This is just part of that big helping of extras that is put into our product by Technical Competence -- the heart of every O-B insulator.

OHIO BRASS COMPANY, MANSFIELD, OHIO

In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

TECHNICAL COMPETENCE the heart of every *Ohio Brass* insulator

Wet flashover on a string of 16 suspension insulator units occurring at 635,000 volts, 60 cycles. All elements are under precise control; voltage measurement, water resistance, and rate of precipitation. These are all read continually and simultaneously.

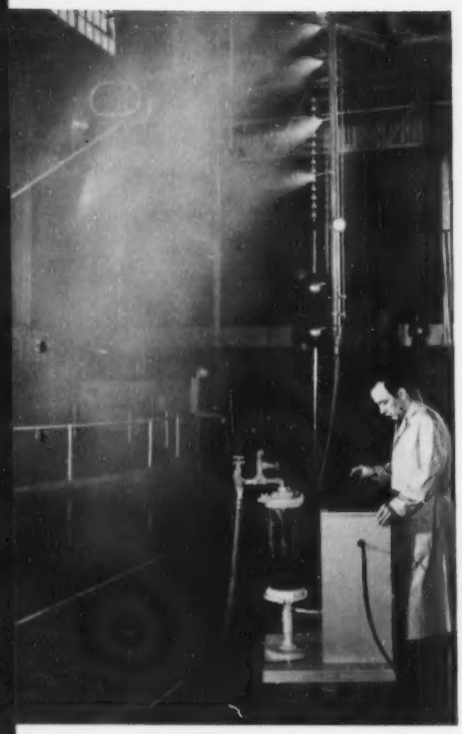
A bag of air in our bag of tricks.....

Given: An air-dry, un-fired bushing cone weighing in the order of half a ton. All surfaces finished. The material, at this stage, no stronger than common chalk. How do you pick it up?

You can't hold it by the fragile flanges, and it's too top-heavy on a skid. But it's hollow, so we insert an air-tight sack inside, inflate the sack, and raise it easily by the grip created through friction.

Regardless of size, we have always made our bushing cones in one piece. These pieces became so large that conventional methods of handling had to be improved. There was no precedent for the design of proper air bags -- no fixed relationship between surface friction and bursting force, which had to be kept in balance. But, this was finally worked out so that, today, it looks quite simple.

It's a neat way around an apparently insurmountable obstacle, and is typical of the ingenuity that is one of the important ingredients of Technical Competence.



Left -- Depending on the locality, natural water resistance can vary widely. Mere "city water" might be almost anything -- certainly not a test standard. Two large storage tanks in the laboratory contain, in one case, water of very low resistance and, in the other, condensate from the factory heating system, having high resistance. These are mixed to produce the required 7,000 ohms per inch-cube. This resistance is under continuous observation while tests are in progress. The water passes through a chamber consisting of an accurately-dimensioned porcelain cylinder, proportioned so that a direct resistance reading is conveniently indicated in ohms per inch-cube. Every gallon of water entering the spray system is thus electrically measured to meet standardized requirements or, in special cases, to depart from such standards to an exactly known degree.

Right -- Rate of rainfall is measured directly on the specimen by means of a standardized rain gauge. When this rate has been adjusted in accordance with the required AIEE standard (2/10-inch per minute) the pressure to produce this is automatically maintained by the pumping system used to feed the nozzles.

How to standardize a shower

"Wet flashover" sounds like an innocent laboratory procedure -- just rig up a hose!

But, AIEE test standards don't say so. They say you must use water with a resistance of 7,000 ohms per inch-cube, and apply it to the specimen at a rate 2/10-inch of rainfall per minute.

When a report comes from our High Voltage Laboratory stating a certain wet flashover, this value is "on the line" because we take uncommon precautions to perform our rain-making according to rules. Anything less precise would "weight" test results; would considerably favor or dis-favor a given specimen; would be like trying to make vital measurements with an elastic yardstick.

This is far more than an isolated test procedure -- it is typical of an over-all attitude, summed up by the expression, "Technical Competence." Equipment, be it in a factory or a laboratory, is no better than the men who use it. In turn, these men are no better than the company they work for, whose Management sets and encourages high standards.

The fact that our High Voltage Laboratory is the largest and finest in the insulator industry is unimportant. The big factor is *how is it used?* Buildings and machinery are merely the mechanical aids applied to making an insulator -- Technical Competence is the heart of it!

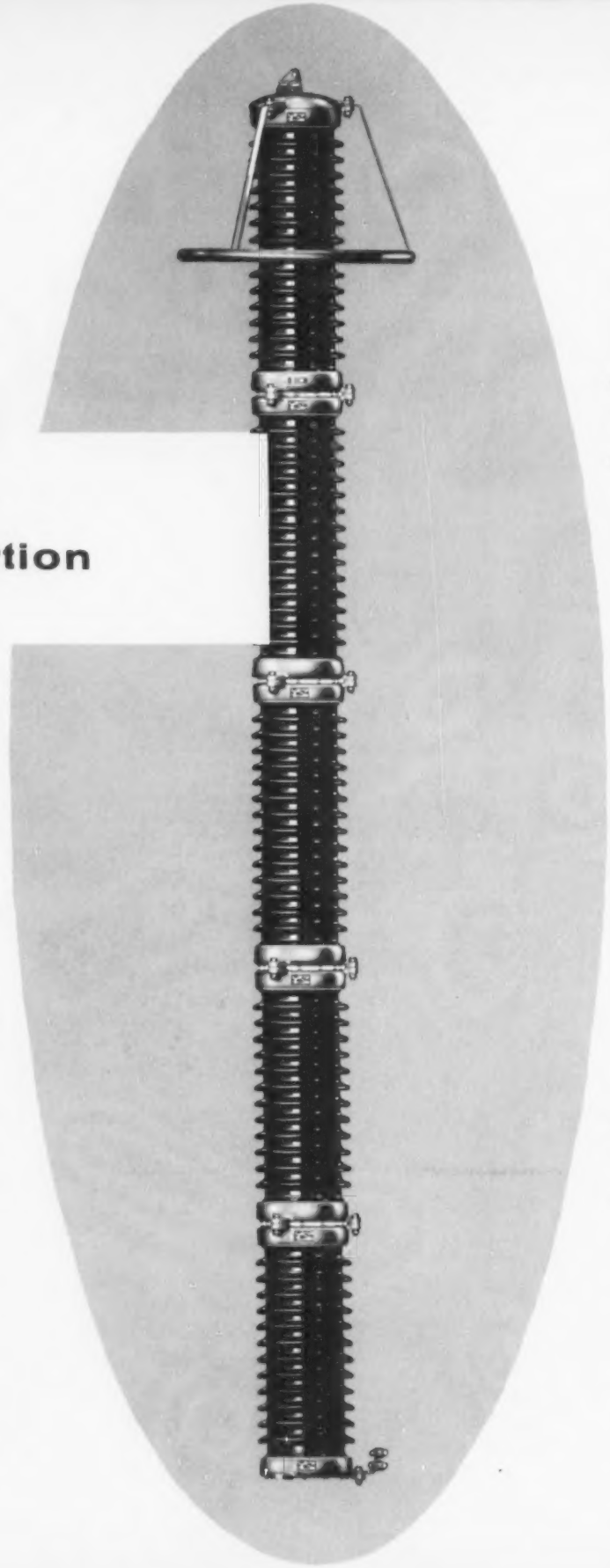
OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Lt'd., Niagara Falls, Ont.

the heart of every *Ohio Brass* insulator

Self-supporting

THOREX ARRESTERS

are inherently free from voltage distortion



All Thorex lightning arresters, from the smallest to the largest, are self-supporting. Obviously, this saves the cost of design and installation of support or bracing structures and insulation. These "incidental" items can often be more expensive than the arrester units themselves.

But, there is still another important factor. Bracing or supporting insulators, connected at intermediate points in the arrester stack, offer the likelihood of electrical surface leakage under conditions of contamination and moisture. This can distort proper voltage division between units, which invites severe arrester damage.

Since the lack of intermediate insulating supports is inherent in the self-supporting Thorex arrester, you have added assurance of long-time reliability and protection -- and not at any premium, in fact, as part of a very substantial saving in installed cost.

Here is additional proof of the sound investment you make when you protect your major apparatus with Thorex lightning arresters.

Ohio Brass

MANSFIELD OHIO • U. S. A.

4413-H

Pad for Charts

(*Continued from page* 146)

in. It is made from a thin piece of fiber board on which billiard cloth is glued and costs only a few cents for material and a few minutes for production.

A typical example of satisfactory results with the use of the pad is shown. Note the two X-marks and two dates, 1953, on back of the left chart. One of each pair was written while the chart was on a hard surface, and one of each pair on the pad. Notice that those marks written on the chart when it was on the pad do not appear on the chart face.

Clamp Aids Armature Lift Measurement

R. L. SNUGGS, Senior Relay Engineer, Ohio Power Co, Canton, Ohio

A crosspiece clamp simplifies measurement of pilot valve "lift" actuating the main control valve on pneumatic operating mechanism of GE Types MA-14, 15, and 16 oil circuit breakers. The lift must be held to close tolerances—only 0.005 in. on soft-seat valves and 0.006 in. on metal-seat valves.

With the circuit breaker in the open position, the method of measuring lift with the clamp is as follows:

1. Close all hand valves between air receiver and control valve to permit operation of pilot valve without closing the circuit breaker.

2. Hold the low-pressure cut-off (63C) closed and turn test-control switch to the "close" position. This raises the pilot-valve armature to a pole piece whose permanent magnetism holds up the valve stem.

3. Clamp device on armature-coil housing so the crosspiece contacts the stem which projects through the top of the housing.

4. Energize the V/CO winding of the pilot-valve armature by momentarily closing the "aa" cut-off switch which returns the pilot valve armature and its "stem" to the closed position.

5. Measure the distance between top of stem and underside of crosspiece on clamp with "feeler" gages. The measurement shows the lift.

Use of the clamp is satisfactory to

Boom Basket Aids Splicing

A boom basket built by Iowa Electric Light & Power Co fastens on the boom head of a line truck and is used for tree trimming and wire splicing jobs. Two men can work quickly and safely in the basket, which has a capacity of 1 ton and can be carried on the truck. Tools are hung on the side of the basket to save handling time.

Save—

MAN HOURS HAULING BURNING

New, FREE BOOKLET *tells about*

LOW-COST BRUSH DISPOSAL

Read how leading tree surgeons, power companies, municipalities, utilities use Fitchburg Chippers to cut disposal costs up to 50%—create customer good will.

Whatever your brush disposal problem, you will more than likely find the answer right in this new booklet, packed with valuable facts, specifications, and suggestions.

Learn how a Fitchburg Chipper can increase the efficiency of your operation. Mail the coupon for your Fitchburg Chipper booklet today.

TEAR OFF and MAIL

FITCHBURG ENGINEERING CORPORATION
Dept. 168, Fitchburg, Massachusetts
Send me the New Chipper Booklet!

*Name*_____

*Address*_____

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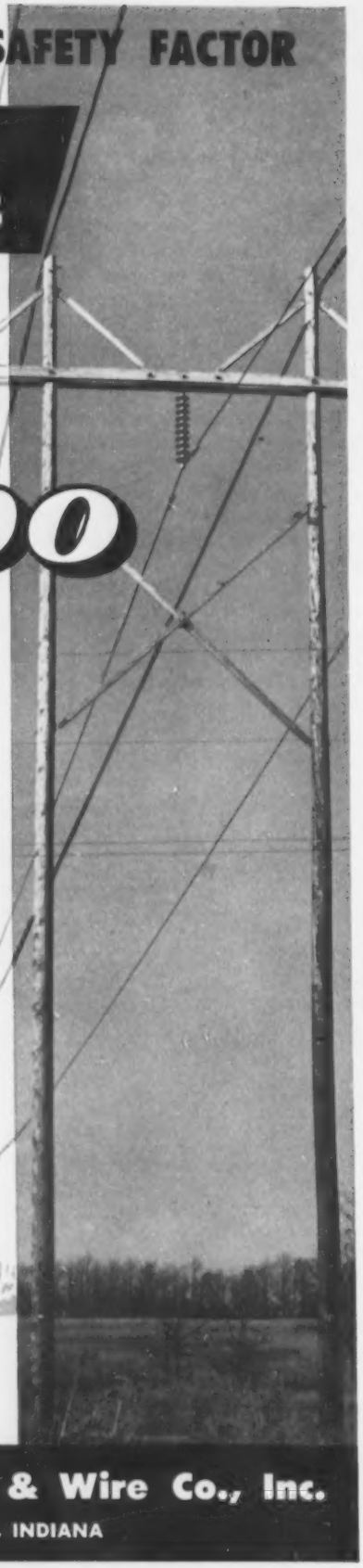
For that EXTRA SAFETY FACTOR

in OVERHEAD GROUND WIRES



Crapo

Weldless
Galvanized
STEEL STRAND

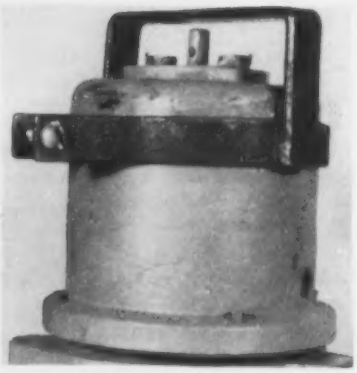
MAXIMUM STRENGTH and dependability in overhead ground or static wire is assured when you specify *Crapo* Weldless Galvanized Steel Strand, specially designed and manufactured to shield transmission lines against lightning.

CONTINUOUS LENGTHS of this 7-wire strand are produced without welds or joints of any kind in either the individual wires or finished strand. High fatigue endurance provides that extra factor of safety so important in overhead ground wire. Laboratory-controlled manufacturing constantly insures high, uniform quality to make it your most practical and economical strand for this purpose.

Crapo GALVANIZING applies a dense, uniform and ductile zinc coating, tightly bonded to the wires for lasting protection against corrosion. *Crapo* Weldless Galvanized Steel Strand is available with Class A, B or C coatings in approved sizes and grades.

Ask your *Crapo* representative for Booklet OG-25 containing Sags and Tension data . . . or write direct!

INDIANA Steel & Wire Co., Inc.
MUNCIE, INDIANA



CROSSPIECE CLAMP is attached to armature housing and simplifies measurement of lift

the breaker manufacturer. The latter's field practice is to measure the gap between the pilot-valve pole piece and its actuating armature. For this method "feeler gages" are extended through the coil-lead outlet in the coil frame after the valve coil is removed. But use of the clamp does not require removal of the pilot-valve coil and re-assembly of the coil frame.

Pin Removal Time Reduced Up to 50%

A pin-remover developed by Green Mountain Power Corp. cuts up to 50% of the time involved in driving out steel pins imbedded in crossarms. In addition, better safety is provided because mashed thumbs and bruised knuckles are prevented.

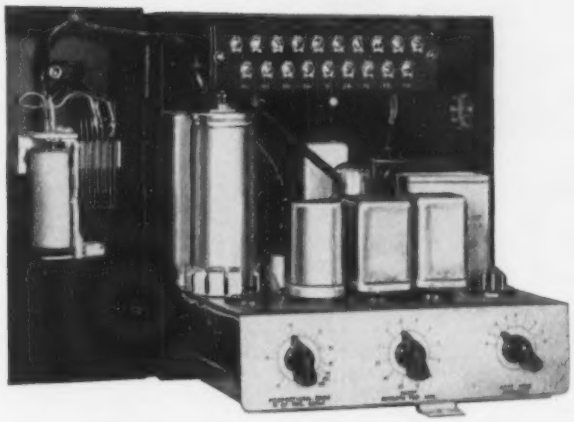
Pin remover is a ½-in. front-wheel auto spindle. An 8 x ¾-in. steel rod is welded at right angles 7 in. from the spindle's tip, and a 2-in. nut is welded to the top of the spindle. The nut provides a larger striking area and prevents mushrooming.

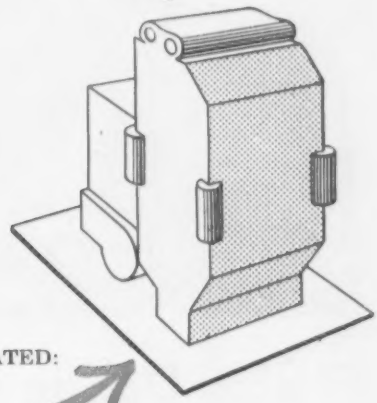
CONTROL ACTIONS:

- *Proportional Action*
- *Reset Action*
- *Rate Action*
- *Anticipatory Action from changes in combustion rate*

CONTROLLING QUANTITY OR FUNCTIONS:

- *Superheat Temperature*
- *Reheat Temperature*
- *Sum or Difference of Superheat and Reheat Temperature*





EQUIPMENT ACTUATED:

- *Desuperheating valves*
- *By-pass dampers*
- *Tilting burners*
- *Gas recirculation dampers*
- *Proportioning dampers*
- *Condenser valves*

THIS ELECTRONIC CONTROLLER HAS THE

flexibility

TO HANDLE YOUR SUPERHEAT-REHEAT CONTROL PROBLEMS

Here is a controller which looks at superheat temperature, reheat temperature or any of their combinations—electronically "computes" the proper control action—and applies it to the correct actuator or group of actuators.

This flexibility of control is vitally important in regulating today's critical superheat-reheat temperatures. Your boiler may employ dampers, tilting burners or valves, separately or in combinations, each having its individual control characteristics. In many steam generators a single actuator affects both superheat and reheat temperatures over part of the load range. As load and furnace conditions require the control to regulate different actuators or groups of actuators, the *control actions* as well as the *controlling quantity or function*—superheat, reheat, or the sum or difference of these temperatures—must be varied accordingly.

The built-in electronic intelligence of the L&N Series '50 Controller enables it to consider all these variables simultaneously. This controller has been supplied with as many as four separate groups of *control actions*—proportional, reset, rate and anticipatory—to meet individual control needs.

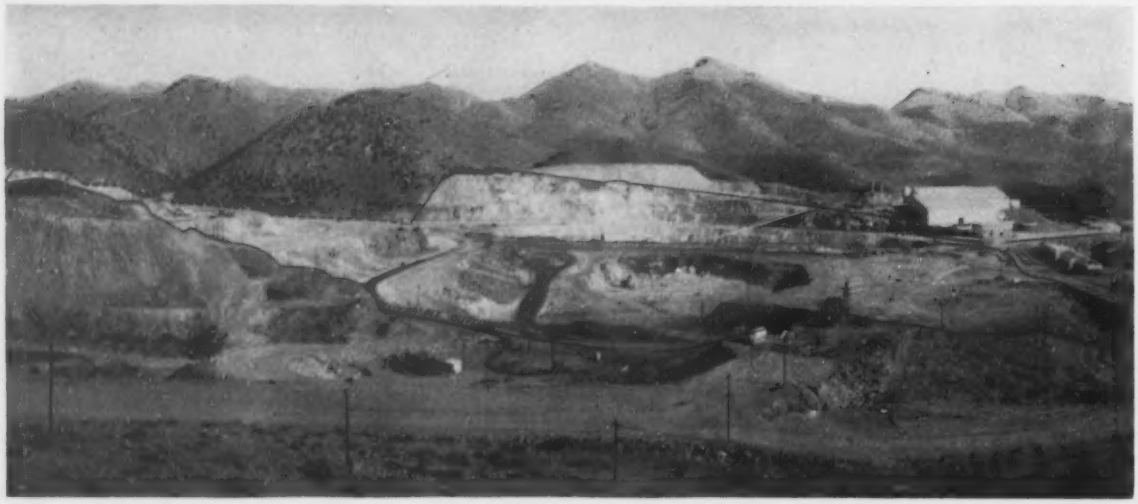
Inherent self-balancing permits rapid automatic transfer from one actuator to another, while introducing a completely new set of control actions, as well as a different control quantity or function.

Inherent flexibility of the Series '50 Controller allows the complete superheat-reheat control system to guard against interaction of the two steam temperature controls and to provide the close temperature regulation your boiler requires.

If you're thinking of tomorrow's—as well as today's—superheat-reheat control problems, why not look to L&N—the only instrument company offering integrated controls for *both* steam and electrical generation. Write Leeds & Northrup Co., 4938 Stenton Avenue, Philadelphia 44, Pa.

LEEDS NORTHRUP

instruments *automatic controls • furnaces*



Phelps Dodge Opens Arizona Copper Mine

Phelps Dodge Corp's $25,000,000 Lavender Pit copper mine near Bisbee, Ariz., has been formally opened after requiring 4 years to uncover the ore body. Under full operation the mine is expected to contribute about 16% of the company's primary copper output.

By the end of August the ore crushing and concentrating plants should be operating at the rate of 30,000 tons of copper yearly. A few months later separate facilities for leaching lower grade ore will add about 8,000 tons of copper yearly.

The pit is reportedly the largest open-pit mine to get into production since World War II. Phelps Dodge undertook the project in 1950 because defense agencies wanted to develop more domestic copper resources after the outbreak of the Korean War.

Lavender Pit is more than 2/3 of a mile long, about ½ a mile wide, and has an estimated production life of approximately 12 years. More than 45,000,000 tons of waste rock overburden have been stripped from the mine site so far. And at least 25,000,000 tons remain to be removed before the huge electric shovels will have access to the ore.

The ore body has been estimated at 41,000,000 tons with an average grade of 1.14% copper and 31,000,000 tons with an average grade of 0.42% to be recovered by a leaching process.

After waste materials are removed at the site, the ore concentrates will be moved 26 miles by rail to the Phelps Dodge smelter at Douglas, Ariz., and after smelting to its electrolytic refinery at El Paso, Texas.

NEMA Approves Standard Signalling Symbols

National Electrical Manufacturers Association has adopted standard symbols for use on architects' drawings to identify components of fire alarm, telephone and other types of signalling systems. NEMA has recommended the new symbols to American Standards Association for inclusion in American Standard Y-32.9, Graphical Electrical Symbols for Architectural Plans. The symbols are under study by an inter-industry task group of ASA Sectional Committee Y-32.

The NEMA standard symbols have a single basic symbol to identify every component of a particular signalling system. The type of component is shown by an inscribed number. There are eleven NEMA standard symbols, eight of which identify components of signalling systems—electric clock, fire alarm, in-and-out staff register, nurse call, paging, private telephone, public telephone and watchman. Remaining three symbols are for audible signals, annunciators and contact devices when installed as separate items rather than as components of a system.

Graybar Expands

Graybar Electric Co has started construction of a combination 70,000-sq ft warehouse and 60,000-sq ft office building in St. Louis. Costing $634,000, completion is expected Jan. 1.

Aluminum Production Is Record in 2nd Quarter

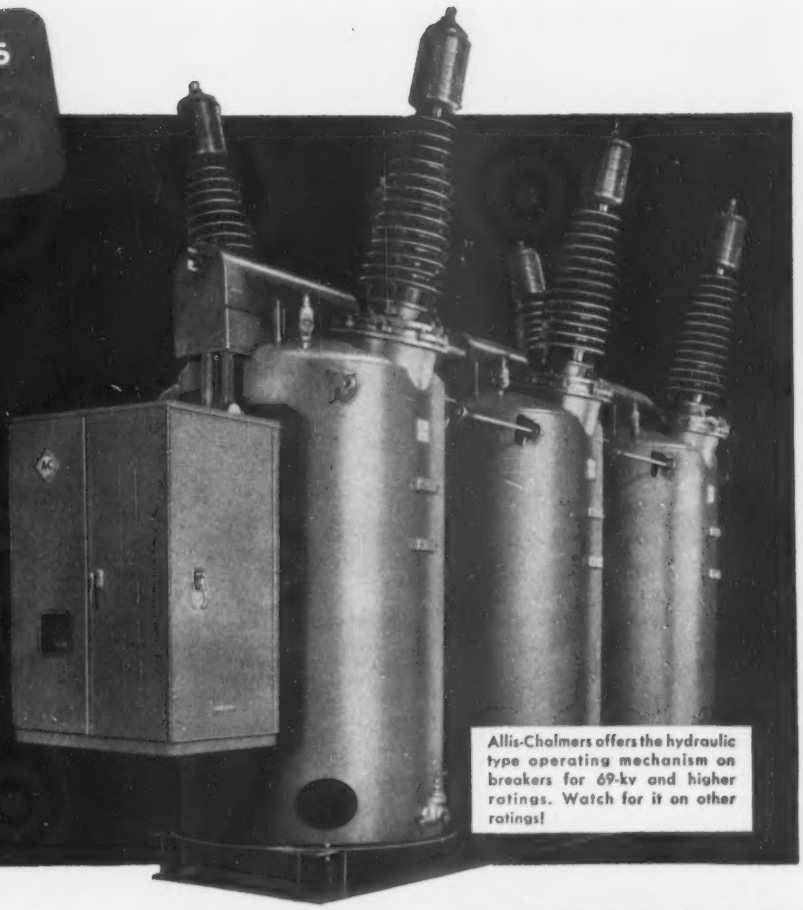
A new quarterly aluminum production record of 732,515,499 lb was set by the U. S. aluminum industry for the 2nd quarter ending June 30, according to Donald M. White, secretary of the Aluminum Association. First quarter production and previous record was 698,137,342 lb.

The quarterly record was made even though primary production in June was 241,360,488 lb, somewhat under May production of 250,287,697 lb, but well above June, 1953, production of 208,303,690 lb.

Primary production in the first six months of the year was almost 20% over the 1,198,407,109 lb produced in

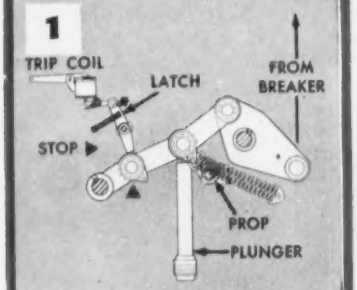
ALLIS-CHALMERS PROGRESS IN Switchgear

Get the 3 features that assure power continuity



Allis-Chalmers offers the hydraulic type operating mechanism on breakers for 69-kv and higher ratings. Watch for it on other ratings!

1



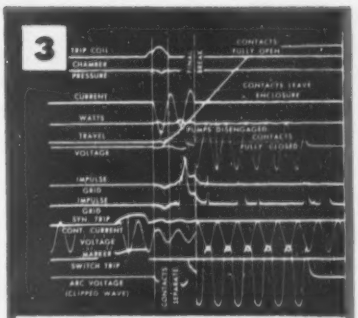
Mechanically trip-free operation gives high speed opening under all operating conditions. Simple uncoupling linkage permits contacts to open independently of closing piston position. Be sure your next breaker has fully mechanically trip-free operation.

2

Turbo Jet interrupter provides fast arc interruption with low arc energy release on both high current and difficult low current switching loads with leading or lagging power factors. Device utilizes bayonet type contact and high speed sickle contact.

Turbo Jet is an Allis-Chalmers trademark.

3



Completely tested — These breakers have been electrically tested to 10,000,000 kva. In addition, each Allis-Chalmers breaker is completely assembled and mechanically tested before shipment to assure easy assembly and proper operation in the field.

A4419

GET MORE INFORMATION! Call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

the same 1953 period and almost as much as during the entire year of 1950.

Coming months are likely to see further increase in primary production, Mr. White predicted. Some new equipment is not yet in full commercial production.

Philco Sales Drop Due to 7-Wk Strike

Philco Corporation sales for the second quarter of 1954 reflect the effects of the strike which stopped all television, radio, and government production in its Philadelphia, Pa., and Sandusky, Ohio, plants for almost seven weeks, reported James H. Carmine, President.

Sales in the second quarter were $60,899,000 as compared with $109,464,000 in the same period last year. Operations for the second quarter resulted in a loss of $703,000 after tax adjustments.

Aluminum Price Up

Aluminum Company of America has increased price of standard 99% aluminum pig ½¢ to 20.5¢ per pound, and 99% ingot by 7/10¢ to 22.2¢ per pound. Adjustment of prices for other products will follow. The price adjustments were necessary following the recent hourly wage increases.

Safety Consulting Firm Established

A new safety consulting organization known as Chase Safety Service, Inc. has been established in Shrewsbury, Mass., and is headed by Alan C. Chase, former engineer with New England Electric System. Consulting service will cover rubber glove, insulator, and transil oil testing; linemen's schooling; accident prevention programs; fire prevention; marine, fleet, and driver safety; plant inspections; and recommendations.

These services are particularly applicable to companies not maintaining large specialized organizations giving full time to safety work.

MANUFACTURING BRIEFS

Daybright Lighting Co has awarded contracts for construction of a $450,000 addition to its Tupelo, La, plant. The addition will have about 100,000 sq ft of floor space. Between 250 and 350 persons will be employed at the expanded Tupelo plant.

General Electric Co has formed a Chemical and Metallurgical Div, comprising the former Chemical Div and Carboloy Dept. Headquarters are in Pittsfield, Mass. . . . The giant stripping shovel being built by Marion Power Shovel Co for Hanna Coal Co,

MANUFACTURERS' EARNINGS

Company	Period Months	Period Ended	Net Income 1954	Net Income 1953	Earnings Per Common Share 1954	Earnings Per Common Share 1953
Amer. Mach & Foundry	6	June 30	$1,840,000	$2,151,000(p)	$0.78(a)	$1.02(a)
Anaconda Wire & Cable Co	6	June 30(t)	2,454,596	3,602,231	2.91	4.27
Combustion Engineering	6	June 30	2,856,527	3,663,787	2.81	3.61(e)
du Pont (E I) de Nemours	3	June 30	78,357,385	58,037,442	1.66(c)	1.22(c)
du Pont (E I) de Nemours	6	June 30	152,150,633	114,758,444	3.22(c)	2.41(c)
Elec. Storage Battery	6	June 30	270,854(f)	354,869	.....	0.39
Motorola Inc	3	June 30	1,214,217	1,466,471	0.63	0.76
Motorola Inc	6	June 30	2,858,301	4,640,679	1.48	2.40
Phelps Dodge Corp	6	June 30	19,326,269	18,878,591	1.91	1.86
H K Porter Co	6	June 30	1,116,036	1,247,421	4.20	4.69
Reynolds Metals Co	6	June 30	9,607,776	9,987,089	5.07	5.26(b)
Rome Cable Corp	3	June 30	235,000	524,000	0.47	1.05
Square D Co	6	June 30	2,634,000	2,075,000	1.91	1.51
Standard Oil Co (Ind)	6	June 30	53,042,928	54,742,446	3.44(a)	3.56(a)
Sylvania Elec Prod Inc	3	June 30	1,401,298	2,395,849	0.41	0.78(u)
Sylvania Elec Prod Inc	6	June 30	3,522,785	5,169,092	1.08	1.70(u)
U S Hoffman Machy Co	6	June 30	370,163	183,229	1.21	0.49

Notes: (a) Based on shares outstanding at close of the period. (b) Based on shares now outstanding. (c) Based on average number of shares outstanding during the period. (e) Adjusted to reflect 5% stock dividend paid in January, 1954. (f) Net loss. (p) Excludes $683,000 (net) non-recurring profit. (t) Preliminary statement. (u) Adjusted to reflect 10% stock dividend distribution in December, 1953.

(Advertisement)

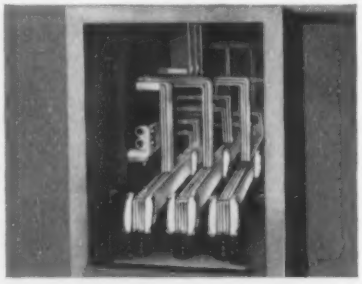
Electrical Applications of Aluminum

An Engineering Service

The Reynolds Metals Company has an engineering service to help you on any type of electrical application for aluminum. For example, Reynolds engineers will conduct meetings with your men and provide them with the latest information on all phases of aluminum design and fabrication. This service is available without cost or obligation.

Reynolds treats each design, construction or production problem as a *new* problem. The Reynolds staff offers you the maturity of experience. Yet, unhampered by precedent, these are men who think in terms of tomorrow's needs *today*. Men whose vigor and skill combine with the latest production facilities and methods to help keep your quality standards highest, your costs low.

For full details contact your nearest Reynolds Branch Office or write Reynolds Metals Company at the address on the facing page.



Aluminum Bus Conductor

More and more aluminum bus conductor is being used in prefabricated duct units for in-building distribution and for electrical and electronic control units. Aluminum's increasing use in electrical applications is due largely to its lower cost, high electrical conductivity, light weight with high strength, ease of fabrication and more certain availability.

For assistance on your bus conductor designs, write to Reynolds Metals Company at the address on the opposite page.

Now You Can Specify REYNOLDS COVERED ALUMINUM CONDUCTOR

for secondary lines and service drops

Now! You can get highest quality Neoprene covered aluminum conductor from Reynolds—single conductor and self-supporting duplex, triplex or quadruplex cables. Also you can rely on Reynolds Engineers to give you impartial information on the right type of covered conductor for your particular secondary distribution line and service drop needs.

Why aluminum conductor? Because the lighter weight of aluminum speeds installation, cuts labor costs and permits longer spans. And because the initial cost of aluminum is lower. These factors add up to important savings to you!

Why *REYNOLDS* covered conductor? Because the tough Neoprene covering is long-lasting and weather-resistant. Because Reynolds has modern facilities for producing conductor and cable with quality control from mine to finished product. Because these modern facilities are backed by experienced production, engineering and sales personnel. And because this help—as proved in countless Reynolds ACSR installations—is readily available to you both in the office and in the field!

For full details on Reynolds Neoprene Covered Aluminum Conductor call your nearest Reynolds Branch Office or write *Reynolds Metals Company, 2584 South Third Street, Louisville 1, Kentucky.*

"REYNOLDS ACSR FOR YOUR TRANSMISSION LINES"
Conforms to or exceeds ASTM and ASA specifications. Reynolds ACSR Manual for Engineers contains complete basic line design, sag, staking, and line erection information, charts and tables. This book is available without charge when requested on your business letterhead.

See "Mister Peepers", starring Wally Cox, Sundays on NBC-TV

REYNOLDS ALUMINUM

MODERN DESIGN HAS ALUMINUM IN MIND

NOT JUST A NEW MODEL—*but*

A NEW CONCEPT

in recording oscillographs

Optically flat cathode-ray tubes are conveniently rack mounted for single-sweep photography and adjustment.

Now . . . the first significant basic advance in multi-channel recording in over a decade, the new Miller CR-1 Cathode-Ray Recording Oscillograph breaks through the "5-kc Barrier" and makes it possible to record up to 16 separate channels at frequencies as high as 50,000 cycles per second. High chart speeds and a patented Miller Optical System provide excellent resolution and clearly readable, permanent records.

A completely self-contained instrument system in a single cabinet, the CR-1 is a convenient, ideal solution to many of today's—*and tomorrow's*—research and development problems. Key features include:

- 16 time-synchronized channels on 8" photographic record.
- Continuous recording of phenomena as high as 50,000 cps; single-sweep photography as high as 250,000 cps.
- Record speeds from 3" to 400" per second through push-button controls; record lengths to 300 feet.
- High-precision system for 1/10, 1/100 and 1/1000-sec. timing lines.
- Automatic record-identification and reference trace recording.
- Unusual ease of operation—individual controls for all channels.
- Integrated, single-cabinet construction—portable and accessible.

Complete information on the CR-1's operation, characteristics and construction will be sent promptly. Write to our Pasadena office:

WM PASADENA

WM MILLER INSTRUMENTS, INC.

CUSTOM INSTRUMENT DESIGNERS AND MANUFACTURERS

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capable of handling 100 ton of rock and earth at each pass, will be electrically powered by General Electric. . . . GE has developed a new aluminum-to-ceramic joining process which will allow aluminum to replace heavier metals in many electrical applications . . . A 125,000-kw turbine-generator, claimed to be the largest ever exported from the United States, will be manufactured by General Electric for installation in the Chiba generating station of the Tokyo Electric Power Co of Japan. At the present only about 1/3 of Japan's electric power comes from steam turbine-generators.

Gai-Tronics Corp, Reading, Pa. has appointed the Stromberg-Carlson Co, Telephone Div, as national sales agent for the Gai-Phone, an electronic telephone design for noise-free communication in noisy areas.

Allis-Chalmers Manufacturing Co, Milwaukee, has reportedly borrowed $9 million more under its $75 million agreement with 14 insurance companies. This brings the total to $60 million borrowed on 3⅝% notes under a 1952 agreement.

Lima Electric Motor Co of Lima, Ohio, has purchased a fleet of station wagons and fitted them as traveling displays to exhibit its line of industrial motors and gearshift drives. Currently the displays are traveling through all the states east of the Mississippi River. Later other states will be visited. R. R. Knierim, sales manager, can be addressed at 39 Findlay Road, Lima, Ohio, for scheduled appearance of the exhibit in particular areas.

Salkover Metal Processing of Illinois, Inc, has moved to its new plant at 2550 Edgington Ave, Franklin Park, Ill. Here the company has about twice the floor area to concentrate all its operations for commercial copper brazing and bright annealing. Both of the old plants in Chicago and Melrose Park have been discontinued and all operations are at Franklin Park.

Labor . . . Allen-Bradley Co, Milwaukee, Wis. and IUEW have a wage reopening settlement providing increases of 4 to 11¢ per hr for production workers. . . . Aluminum Co of America and United Steel Workers, CIO, have agreed on 5¢ per hr wage increase.

FULL GRIPPING SURFACE

with

BLACKBURN *Aluminum* SERVICE WEDGE CLAMP

Conductor is in Contact with Wedge for Entire Length of Slider

This longer-contact gripping surface adds years of trouble-free life to the connection. *It's easily installed.*

- **Stainless steel bail can be snapped on and off without tools. Its strength exceeds rated breaking strength of conductors.**
- **Removable aluminum slider allows clamp to be installed without threading through clamp.**
- **Drop wire can be pre-sagged and cut to exact length—saves conductor—saves time.**
- **Clamp can be attached to bare neutral at any point in the span.**

The BLACKBURN Aluminum Service Wedge Clamp covers a conductor range of 2-6 sol, Aluminum and 4-6, ACSR. The wedge and bail are Stainless Steel—the removable slider, heat-treated Aluminum.

Available through electrical wholesalers everywhere

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CEDAR POLES
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Light in weight and clean. PENTAchlorophenol treated in our modern plant for protection against decay, moisture and insect damage.

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MINNEAPOLIS, MINNESOTA
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R. G. HALEY & CO.
SPITZER BLDG. TOLEDO 4, OHIO

SALES ASSIGNMENTS

D. W. Onan & Sons, Inc, Minneapolis, has named Charles J. Helmholtz as direct factory sales engineer covering the New England States. Helmholtz, formerly with Fairbanks-Morse Co for 34 years, will be headquartered in West Medford, Mass.

United States Rubber Co has transferred Arthur A. Gingell, sales representative for the electrical wire and cable department of the Mechanical Goods Division to the San Francisco branch. He will assume the responsibilities formerly held by the late Fred D. Benz, a U. S. Rubber sales agent. Gingell, formerly of the Cleveland office, has been a U. S. Rubber salesman since 1941.

MEETINGS CALENDAR

International Electrotechnical Commission
50th Anniversary Meeting, University of Pennsylvania, Philadelphia, Sept. 1-16.

American Society of Mechanical Engineers
Fall Meeting, Schroeder Hotel, Milwaukee, Sept. 8-10; Annual Meeting, Statler Hotel, New York, Nov. 28-Dec. 3.

Rocky Mountain Electrical League
Annual Fall Convention, Stanley Hotel, Estes Park, Colo., Sept. 12-15.

Illuminating Engineering Society
National Technical Conference, Chalfonte-Haddon Hall, Atlantic City, N. J., Sept. 13-17.

Instrument Society of America
1st International Instrument Congress-Exposition, Philadelphia, Sept. 13-24.

Pennsylvania Electric Association
47th Annual Meeting and Business Conference, William Penn Hotel, Pittsburgh, Sept. 14-15; Fall Meeting, Systems Operation Committee, Alexander Hotel, Hagerstown, Md., Oct. 7-8; Fall Meeting, Relay Committee, Hotel Alexander, Hagerstown, Md., Oct. 14-15; Fall Meeting, Electrical Equipment Committee, Hotel Robert Treat, Newark, N. J., Oct. 19-20.

Public Utilities Association of Virginias
36th Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va., Sept. 16-18.

Edison Electric Institute
Accident Prevention Committee, Benjamin Franklin Hotel, Philadelphia, Sept. 20-21; Industrial Relations Committee, Round Table Conference, Palmer House, Chicago, Sept. 27-29; Meter and Service Committee, Leland Hotel, Springfield, Ill., Sept. 27-29; EEI-AGA Tax Committee, Brown Palace Hotel, Denver, Colo., Sept. 29-Oct. 1; Prime Movers Committee, De Witt Clinton Hotel, Albany, N. Y., Oct. 4-5; Area Development Workshop, Hotel Statler, Cleveland, Ohio, Oct. 7-8; Transmission and Distribution Committee, Sir Francis Drake Hotel, San Francisco, Calif., Oct. 7-8; Electrical Equipment Committee, Hotel Statler, Hartford, Conn., Oct. 11-12; Industrial Relations Committee, in conjunction with North Central Electrical Association, Minneapolis, Minn., Nov. 18-19; Prime Movers Committee, Astor Hotel, New York, Nov. 29-30.

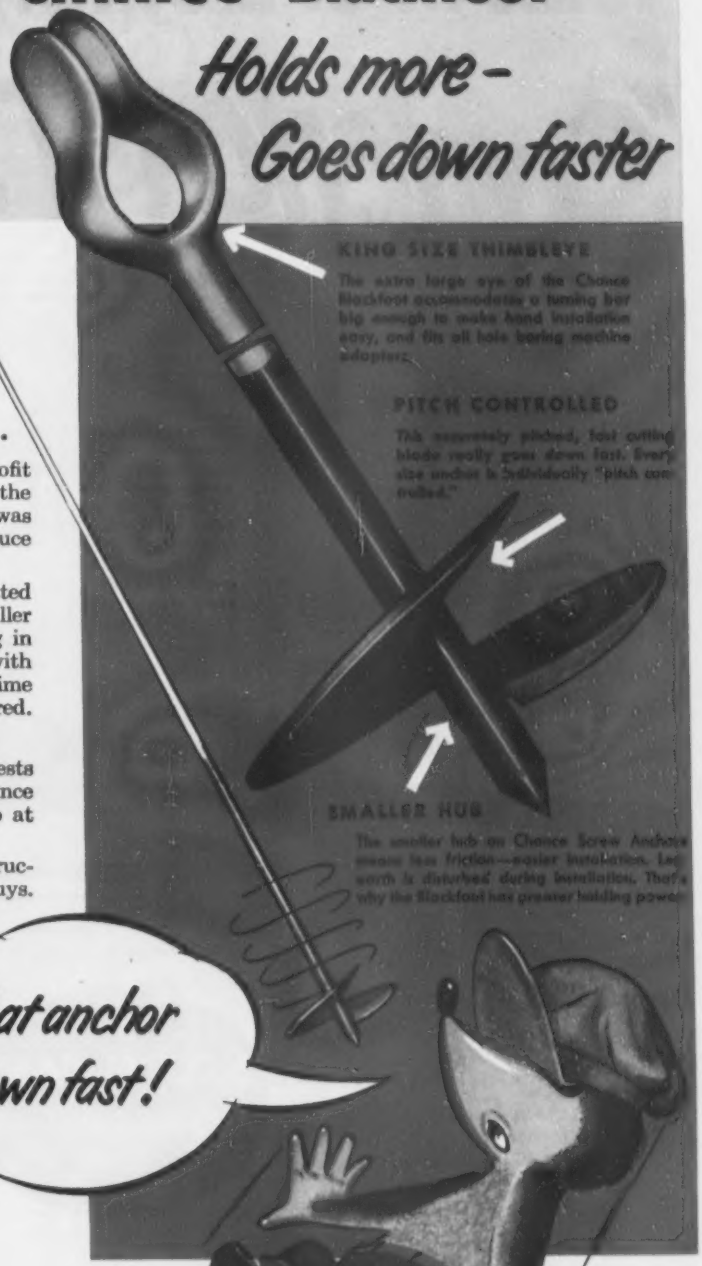
Missouri Valley Electric Association
Accounting Conference, Jefferson Hotel, St. Louis, Mo., Sept. 23-24; Sales and Rural Conference, President Hotel, Kansas City, Mo., Oct. 6-8; Industrial and Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 3-4, 1955; Engineering Conference, President Hotel, Kansas City, Mo., March 23-25, 1955.

Southeastern Electric Exchange
Engineering and Operation Section, Thomas Jefferson Hotel, Birmingham, Ala., Sept. 23-24; Accounting Section, Roanoke Hotel, Roanoke, Va., Oct. 21-

Give the GUY a CHANCE

the CHANCE "Blackfoot"

Holds more - Goes down faster


KING SIZE THIMBLEYE
The extra large eye of the Chance Blackfoot accommodates a tamping bar big enough to make hand installation easy, and fits all hole boring machine adapters.
PITCH CONTROLLED
This accurately pitched, fast cutting blade really goes down fast. Every size anchor is individually "pitch controlled."
SMALLER HUB
The smaller hub on Chance Screw Anchors means less friction—easier installation. Less earth is disturbed during installation. That's why the Blackfoot has greater holding power.

CAN BE INSTALLED BY MACHINE TO CUT LINE CONSTRUCTION COSTS . . .

Power companies trying to trim costs can profit by the experience of a Florida Utility where the use of the big Chance 15 inch Screw Anchor was combined with machine installation to reduce anchoring costs.

The use of the fifteen inch Blackfoot permitted one anchor to take the place of several smaller ones. This added up to a considerable saving in material costs. Speedy machine installation—with fewer anchors to install—slashed installation time to a small fraction of what was previously required.

How did these anchors hold?

Company personnel conducted their own pull tests to determine the holding power of these Chance Anchors. The dynamometer showed *no* creep at 22,000 pounds!

You can protect your investment in line construction by specifying Chance Anchors for your guys. They really hold the load!

ABC INDUSTRIES

A·B·CHANCE CO.

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SAN FRANCISCO, CALIFORNIA

ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS

CA54-8

REVOLUTIONARY NEW IDEA IN SPLICING...

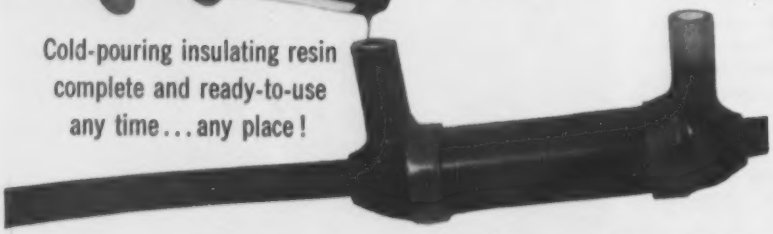
"SCOTCHCAST"!

Now you can turn out completely insulated, sealed cable splices *in minutes* with "Scotchcast" Electrical Embedment Resin No. 4 in new ready-to-use "Unipak".

"Unipak" is a new single-package envelope containing famous "Scotchcast" Resin and hardener. To prepare the "Scotchcast" for use, you simply squeeze the package to mix—then, pour the activated resin and hardener into the splice mold. And, once poured, "Scotchcast" Insulating Resin quickly cures into a tough, protective casing without the application of heat. It resists acids, alkalies, solvents, and oils—has excellent adhesion to most metals, plastics, and conductors.

The "Scotchcast" Splicing Kit contains everything you need for a perfect splice every time!

Cold-pouring insulating resin complete and ready-to-use any time... any place!



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We'll be glad to send you complete information on this revolutionary new idea in splicing—just clip and mail the coupon.

SCOTCHCAST BRAND Electrical Embedment Resin

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MINNESOTA MINING AND MFG. CO.
St. Paul 6, Minn.

Please send me complete information on the new "Scotchcast" Splicing Kit. I understand there is no cost or obligation.

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The term "Scotchcast" is a registered trademark of Minnesota Mining and Manufacturing Company, St. Paul 6, Minn. General Export: 122 E. 42nd St., New York 17, N.Y. In Canada: London, Ontario Canada.

3M COMPANY

22; General Sales Conference, Roosevelt Hotel, New Orleans, La., Oct. 28-30; Accident Prevention Committee, Heidelberg Hotel, Baton Rouge, La., Nov. 11-12; Annual Meeting, Boca Raton Hotel and Club, Boca Raton, Fla., Mar. 21-23, 1955; Engineering and Operation Section, Roosevelt Hotel, New Orleans, La., April 7-8, 1955.

*__Atomic Industrial Forum, Inc.__
Meeting on "What the New (Atomic) Law Means", Hotel Plaza, New York, Sept. 27-28; Meeting on "Atomic Opportunities in New England", in conjunction with New England Council, Statler Hotel, Boston, Oct. 20.

__American Institute of Electrical Engineers__
Committee on Petroleum, Conference on Electrical Applications in Petroleum Industry, Mayo Hotel, Tulsa, Okla., Sept. 27-29; Middle Eastern District Meeting, Abraham Lincoln Hotel, Reading, Pa., Oct. 5-7; Fall General Meeting, Morrison Hotel, Chicago, Oct. 11-15; Winter General Meeting, Hotel Statler, New York, Jan. 31-Feb. 4, 1955.

__Institute of Radio Engineers__
Professional Group on Industrial Electronics and Pittsburgh Section of IRE, Symposium, Mellon Institute, Pittsburgh, Pa., Sept. 29-30.

__International Association of Electrical Leagues__
19th Annual Conference, Bellevue-Stratford Hotel, Philadelphia, Pa., Sept. 29-Oct. 2.

__National Electronics Conference__
10th Annual Conference, Hotel Sherman, Chicago, Oct. 4-6.

__National Association of Electrical Distributors__
Pacific Zone Convention, Mark Hopkins Hotel, San Francisco, Oct. 4-7.

__Indiana Electrical Association__
Annual Convention, French Lick Springs Hotel, French Lick, Ind., Oct. 6-8.

__Interstate Power Club__
Meetings will be held at Hotel Martinique, New York, on following dates: Oct. 11, Dec. 6.

__Controllers Institute of America__
Annual Meeting, Edgewater Beach Hotel, Chicago, Ill., Oct. 10-13.

__National Safety Congress-Exposition__
Conrad Hilton Hotel, Chicago, Oct. 18-22.

__Oklahoma Utilities Association__
Electric Light and Power Division, Western District Meeting, Duncan, Okla., Oct. 21; Eastern District Meeting, Ada, Okla., Oct. 22; Annual Convention, Mayo Hotel, Tulsa, Okla., March 24-25, 1955.

__Public Information Program__
Workshop Conference, Chase Park Plaza Hotel, St. Louis, Oct. 28-29.

__National Electrical Manufacturers Association__
Annual Meeting, Haddon Hall Hotel, Atlantic City, N. J., Nov. 8-11; Winter Meeting, March 7-11, 1955.

__National Association of Railroad and Utilities Commissioners__
Annual Convention, La Salle Hotel, Chicago, Ill., Nov. 8-12.

__American Standards Association__
36th Annual Meeting and 5th National Conference on Standards, Hotel Roosevelt, New York, Nov. 15-17.

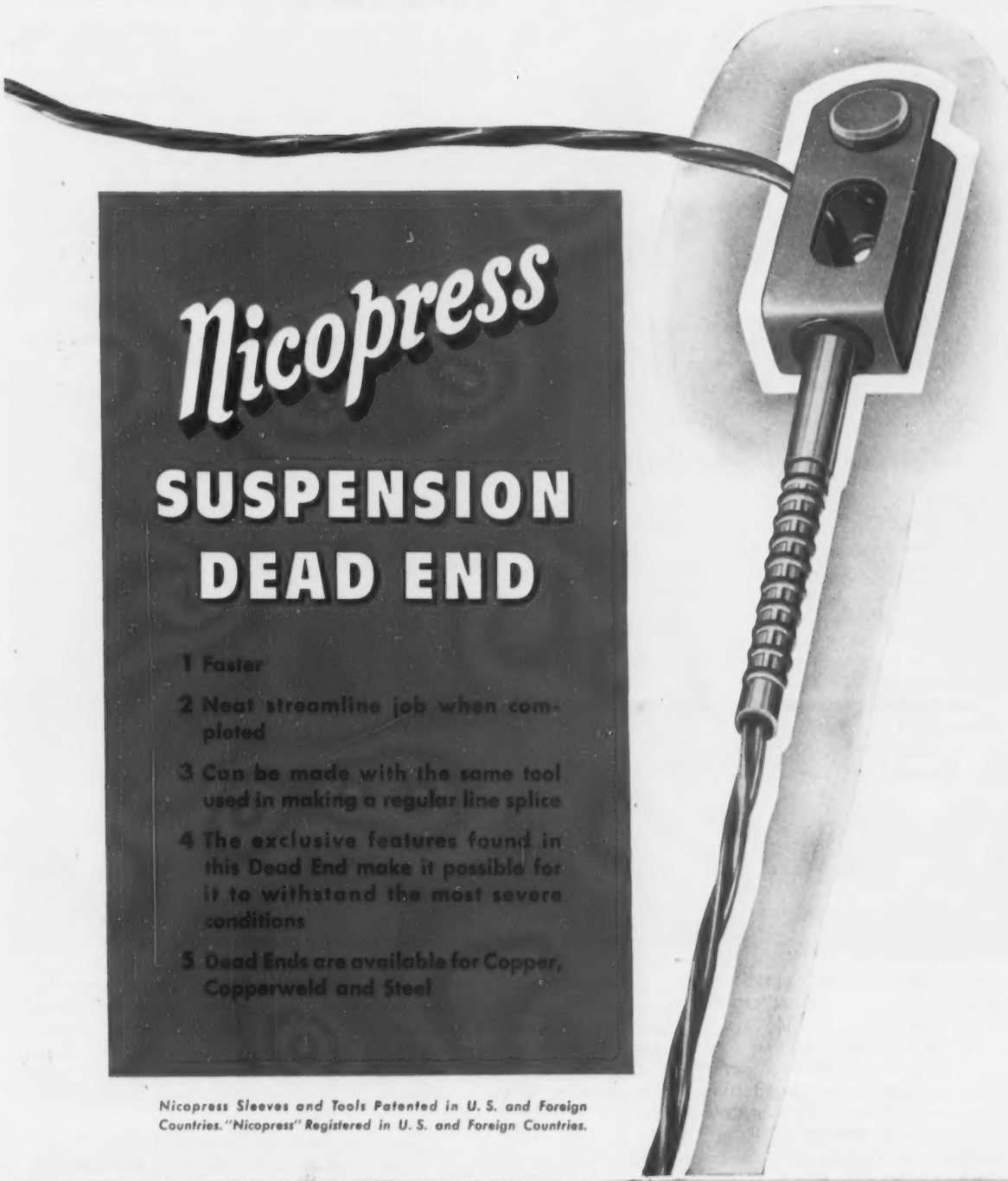
__21st National Power Show__
Sponsored by American Society of Mechanical Engineers, Commercial Museum, Philadelphia, Dec. 2-7.

__Eastern Joint Computer Conference-Exhibition__
Bellevue-Stratford Hotel, Philadelphia, Dec. 8-10.

__National Association of Purchasing Agents__
24th Annual Mid-Winter Conference, Public Utility Buyers' Group, Shamrock Hotel, Houston, Tex., Feb. 13-15, 1955.

__Southern Safety Conference-Exposition__
Jung Hotel, New Orleans, La., Feb. 27-Mar. 1, 1955.

*Additions this week.



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SUSPENSION DEAD END

1 Faster

2 Neat streamline job when completed

3 Can be made with the same tool used in making a regular line splice

4 The exclusive features found in this Dead End make it possible for it to withstand the most severe conditions

5 Dead Ends are available for Copper, Copperweld and Steel

Nicopress Sleeves and Tools Patented in U. S. and Foreign Countries. "Nicopress" Registered in U. S. and Foreign Countries.

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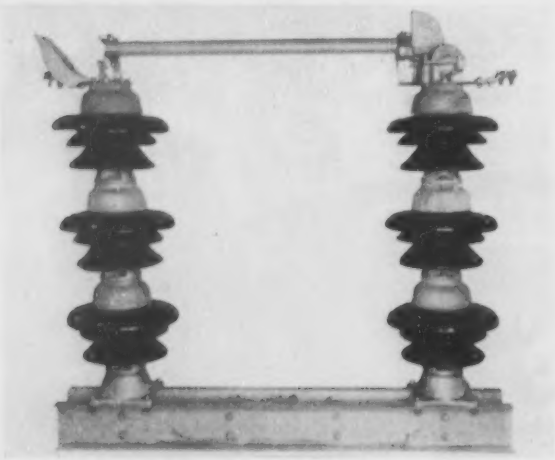
5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

NEW EQUIPMENT



Power Fuses

Type BF 115-kv power fuses are equipped with tubes designed to eliminate electrostatic discharge from the entire length of the fuse elements. This is accomplished by building into the tube structure a resistive conducting layer which is electrically connected to the hardware at each end of the tube.

With this design the electrostatic discharge is from the outside of the tube and not from the relatively small diameter of the fuse element. Fuse element and outer conducting layer are at the same potential, therefore, there is no discharge between them. This condition relieves the horn fiber lining of the fuse tube of the damaging effects of high electrical stress found in conventional fuse tubes.

USCO Power Equipment Corp, P. O. Box 629, Birmingham 1, Ala.

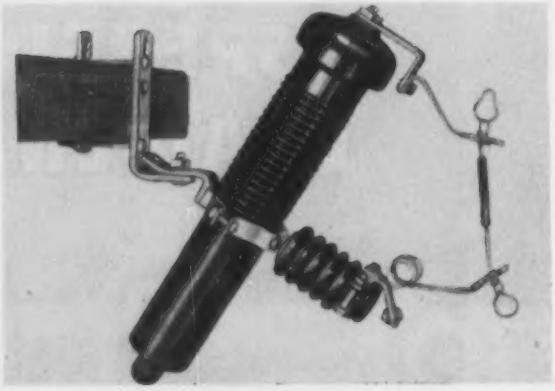
Combined Arrester-Cutout

Combined arrester-cutout device provides economical protection of rural transformers. Consisting of a Type D valve arrester and an open-link STF fuse cutout, the device has a single mounting bracket for crossarm or transformer mounting. It is angle mounted to facilitate refusing.

The Type D valve arrester has low impulse sparkover and low IR drop. It is porcelain housed and provides all the features of L-M's Type E, including the isolator.

Arrester-cutout is available in three ratings—9-kv arrester with 7.8-kv cutout, 10-kv arrester with 7.8-kv cutout, or 15-kv arrester with 15-kv cutout.

Line Material Co, 700 W. Michigan St, Milwaukee 1, Wis.



Distribution Transformer

Lightweight, pole-mounted transformer is rated 167 kva. The "featherweight" is designed for installation in congested business areas where heavier poles, double poles, or underground transformers are not feasible.

Transformer weighs less than 1,500 lb. It is lower in height than average 100-kva transformer. This distribution transformer is available in standard voltages up through 13,200 v.

Pennsylvania Transformer Co, Box 330, Canonsburg, Pa.

Dual Capacitor

Dual capacitors for air conditioners provide power factor correction. The two-in-one units occupy less space and weigh less than two single units. They are enclosed in drawn-oval, steel cases and use low-loss Kraft paper, aluminum foil, and Pyranol dielectric. Each unit has three bushings, one of which is common to both sections. The capacitors are available in ratings of 236, 250, 330, and 440 v ac with selective microfarad ratings.

General Electric Co, 1 River Rd, Schenectady 5, N. Y.

Al-Coated Steel Wire

Aluminum-coated steel wire is made by a continuous hot-dip process. Thickness and weight of coating is said to be accurately controlled.

Called ACCO Aluminized, it is now available as 7-wire strand in Siemens-Martin, High Strength, and Utility. Physical properties conform to ASTM Spec A-122-52-T for galvanized strand. Same sag tables may be used as for galvanized strand.

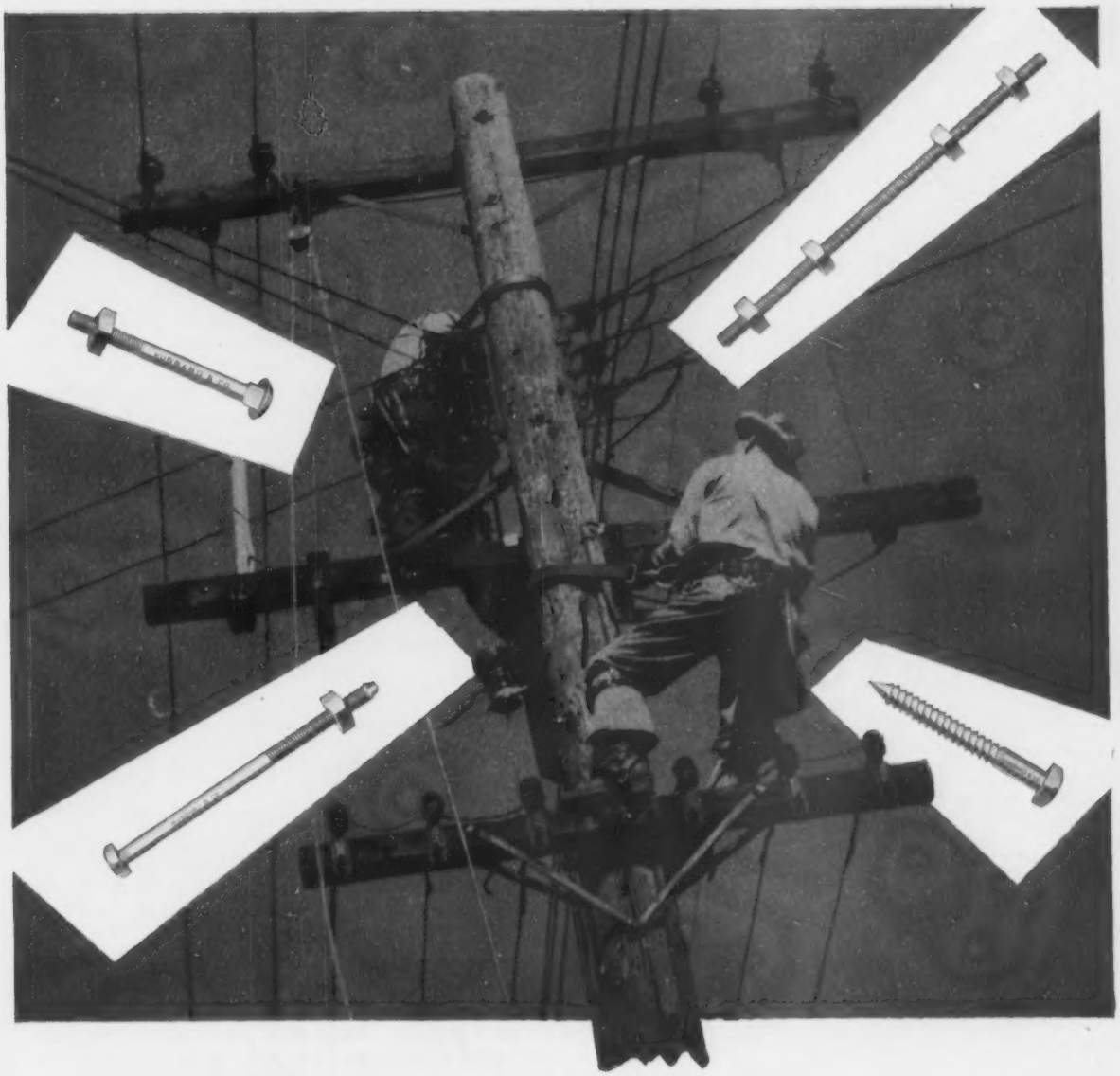
Coating is bonded tightly to its metal base and can be drawn to any desired thickness. Based on coatings equal in thickness to zinc, resistance to weathering in industrial atmospheres is expected to be 2 to 20 times as long. Ask for price Bulletin AL-S-1000.

American Chain & Cable Co, Inc, 929 Connecticut Ave, Bridgeport 2, Conn.

Grounding Clamp

Grounding clamp, Type GA-H, meets the grounding requirements for H-beam fence posts. Clamp, of high

HOLD EVERYTHING!



with HUBBARD Hardware

Machine bolts, carriage bolts, double arming bolts, and lag screws—the workaday items of the electrical industry—are specially designed by Hubbard with careful attention to the functions which they must serve.

All crossarm and double arming bolts have the original Hubbard DRIVEPOINT feature. All bolts and lag screws are formed from new open hearth steel and are Hubbard Double-Dip Hot Galvanized. Special care is used to keep threads clean and smooth during galvanizing.

If it's Hubbard, it's made to serve efficiently.

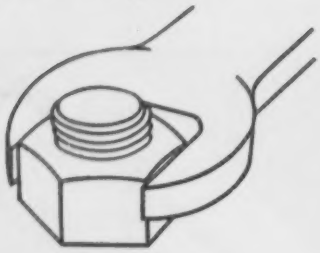
HUBBARD AND COMPANY

ESTABLISHED 1843

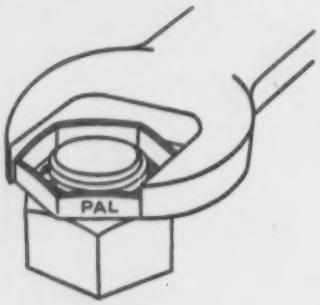
PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

Get it tight—



then KEEP it tight



with a

PALNUT LOCK NUT

JUST spin on a PALNUT Lock Nut and lock with 1/3 turn of a wrench. Takes but seconds, cost is negligible, protects for the life of the installation. PALNUT Lock Nuts exert a double locking action that prevents the plain nut from loosening and the bolt from backing out, under severest vibration. Eliminates further checking or re-tightening on mechanical assemblies —maintains perfect conductivity on electrical connections.

Widely Used Thruout Utility Field

PALNUT Lock Nuts have been used for years on wood poles, steel towers, fittings, connectors, switches, hardware, transformers, etc. Complete range of sizes, in all finishes and materials used by utility industry. Get Bulletin #577.

THE PALNUT COMPANY
51 Cordier Street,
Irvington 11, N. J.

PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

copper alloy, is designed with slots in the casting to accommodate H-beam fence posts from 1⅞ x 1⅞ to 2½ x 2½ in. Bolt heads are recessed and captured in the slots, allowing single-wrench installation. The GA-H takes a conductor range of AWG 4 solid through 250 Mcm copper cable.
Burndy Engineering Co, Norwalk, Conn.

Fluorescent Lamp

Rapid-start, 8-ft fluorescent lamp is claimed to produce more light than any previous standard fluorescent type. High-lumen lamp can produce light at an efficiency of 70 lumens per watt, according to Sylvania engineers. Approximate initial brightness is 2,560-foot lamberts.

Because of its relatively high loading, the lamp is recommended for well ventilated fixtures or out-of-doors applications. Rated life on 3-hr cycle is 7,500 hr. It is presently available as standard cool white color. Nominal wattage is 100; operating current, 0.815 amp; operating voltage, 140; bulb, T12; approximate initial lumens, 7,000.
Sylvania Electric Products, Inc, Salem, Mass.

Emergency Light

Battery unit automatically gives light and 115-v power when the normal electric power fails. This Model 2VX15 unit has a 100-amp lead-acid battery, a 6-v 35-w lamp, and a dc-to-ac rotary convertor. Models are available for 40, 60, 80, 100, and 150 w ac output. **Hobby & Brown Electronic Corp, 55 Front St, Rockville Centre, N. Y.**

Street Fluorescent Luminaire

V-shaped fluorescent luminaire accommodates four 6-ft lamps, providing a Type IV distribution pattern. It is designed for mounting 25 ft or higher for street lighting. Brightness level is 1/20th the level of small-source luminaires having similar light distribution.

Each leg of the V-shaped unit houses two lamps. One ballast furnishes power to two lamps—in the same or opposite legs. Terminal blocks facilitate connections. Metallic parts are aluminum with non-ferrous fittings. Cover is translucent plastic, hinged at top and latched at bottom. Cover gaskets provide weather and bug proofing.
Line Material Co, 700 W. Michigan St., Milwaukee 1, Wis.

Off-Peak Load Control

Use of centralized automatic off-peak load control, the Peak-Trol System, is claimed to increase power load factors and reduce demand charges. At the same time it improves voltage regulation and service.

By employing a signal transmitter at the substation and a small receiver at the water heater location, the system is ready for automatic operation. Normally, all equipment is at rest except the wattmeter load detector. When load goes above an upper setting, the transmitter sends a signal over the power line to turn off water heaters. Likewise, when load goes below a lower setting another signal is sent to turn on heaters.

The signal is generated by a 360-cps motor generator. For one signal the 360-cps current is phased to add to the positive half of the 60-cps wave and subtract from the negative half. For the opposite signal the positive half is flattened and the negative half peaked.

The receiver uses a vacuum-tube

(*Continued on page* 179)

Solving load problems as more homes "go electric"

The past decade has seen utilities match the nation's tremendous housing expansion with corresponding system growth.

As more homes "go electric," the future points to increasing loads on these lines. On the following eleven pages, Mr. F. D. "Whitey" Hurd, Westinghouse Consulting and Application Engineer, and product experts discuss some specific ways you can meet this trend—on a practical basis.

On the next page, Fred Rick of the Meter Division leads off with news about the new meter socket . . .

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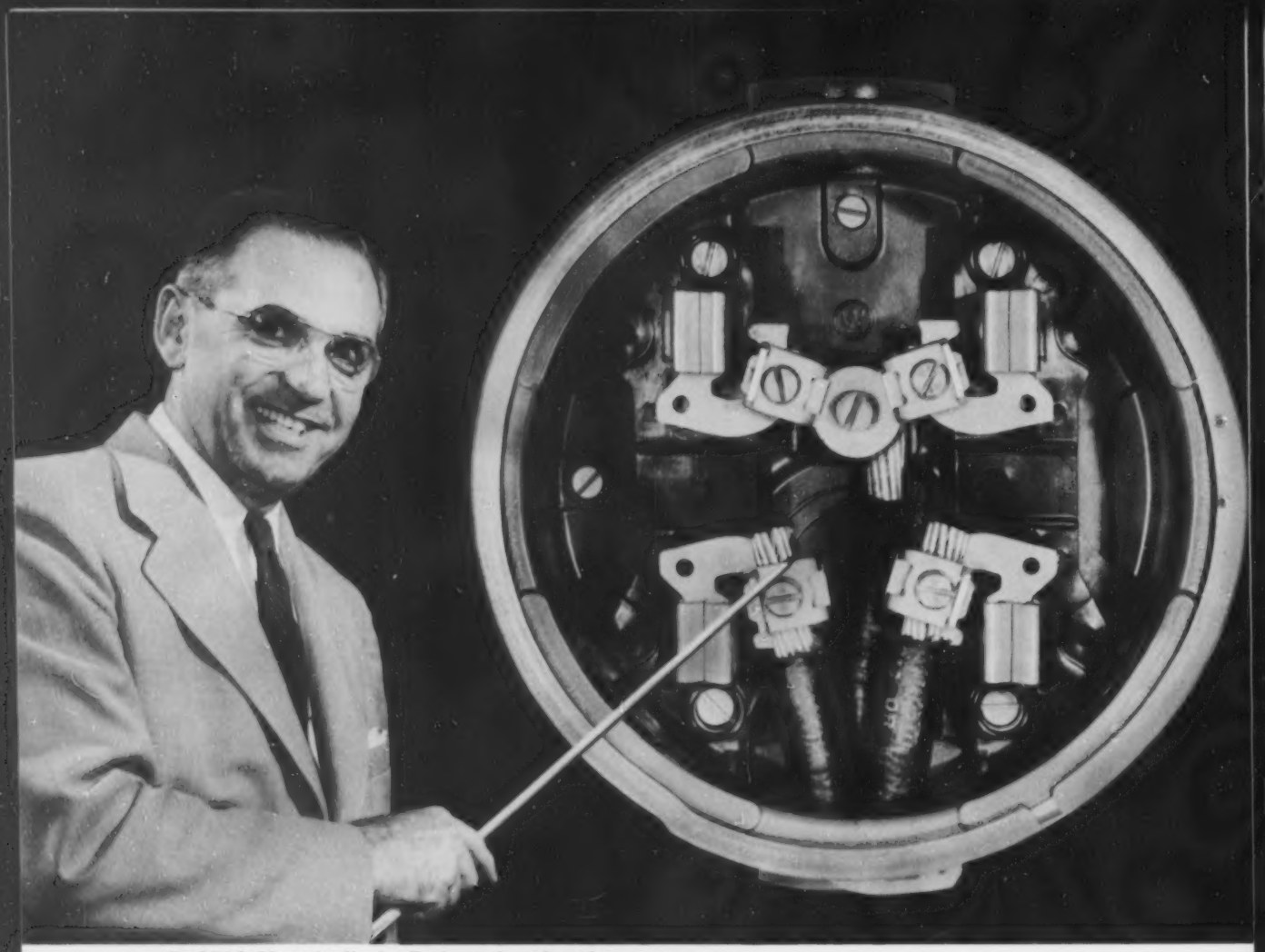


Fred Rick, Meter Application Engineer, shows how the new meter socket easily accommodates heavy conductors—up to #0 gauge.

New meter socket wires easily with up to #0 conductors

Heavy conductors up to #0 are no problem with the new Westinghouse die-cast aluminum meter socket. Wiring is simplified because of the new bus-type terminals. These terminals swivel for easy alignment with the conductors. On installations using heavy conductors, the tops of the terminals may be removed, conductors simply dropped into place, and the tops replaced. Smaller wires may be inserted into the terminals without removing the tops.

The socket has outside hubs to give more room inside for wiring. Terminals have large contact surfaces with "follow" action, insuring a solid connection on aluminum or copper conductors. All sockets have a breakout in the back for use when three-point mounting is required.

A new sealing ring which can be installed without tools is supplied with this socket. Since the socket, ring and meter rim are all iridited-aluminum, no electrolytic corrosion can take place.

The socket is available for either single or polyphase service with two or three outlets, in 1-inch, 1¼-inch and 1½-inch hub sizes. For more information, write for booklet B-6377, which contains the complete story about this socket.

YOU CAN BE **SURE**...IF IT'S

New secondary capacitors: 40% lighter, easier to handle

As they "power up" for modern living, America's homeowners are buying over a million air conditioning units a year. That looks good on load growth charts—but what about power factor?

The new Westinghouse 3 and 5-kvar secondary capacitors are the answer. They're inexpensive, light, easy to handle and completely flexible. They'll enable you to boost power factor on heavily loaded secondaries *at lower cost per kilovar than ever before.*

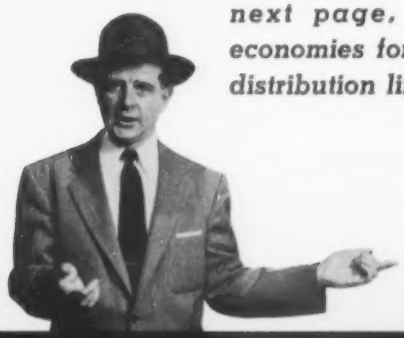
These new secondary capacitors offer you an exclusive cost-reducing design feature: tubular cases of 16-gauge extruded aluminum. They weigh only 16 and 25 pounds respectively—*40% less than comparable units.* A lineman can carry them up a pole and install them in a matter of minutes. They will never corrode —never need painting.

These capacitors can be mounted with bushings up or down—bolted directly to the pole or mounted on the crossarm with a standard EEI-NEMA bracket. Leads are furnished and, when required, external bushing-mounted indicating fuses can be supplied.

The use of secondary capacitors can be readily justified. You can prove this for your system by following the simple procedure outlined in a technical paper, *Application of Secondary Capacitors on Overhead Systems* by Hamilton Brooks. Write for it today.

Hamilton Brooks, Supervisory Engineer, Capacitor Section, with the new 3 and 5-kvar capacitors. Designed for use with 7½ and 15-kva transformers, the capacitors usually are placed about two-thirds of the distance from the transformer to the end of the line.

Austin Fink of the Switchgear Distribution Apparatus Department points out, on the next page, important economies for residential distribution lines.



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Austin Fink, Manager of Recloser, Cutout and Fuse Engineering, shows the standard 5.2-kv enclosed cutout box with its seven interchangeable doors.

Enclosed cutout interchangeability reduces distribution costs

One porcelain box—seven interchangeable doors! That's what you get with Westinghouse enclosed fuse cutouts—and it means a lot to you in the face of rapidly rising residential loads.

It means you don't have to change the entire cutout when fault or load current exceeds the rating of your present standard cutout. All you have to do is replace the door. It saves labor out on the line. Reduces inventory, too—for change of ratings, only the doors need to be stocked, not the boxes.

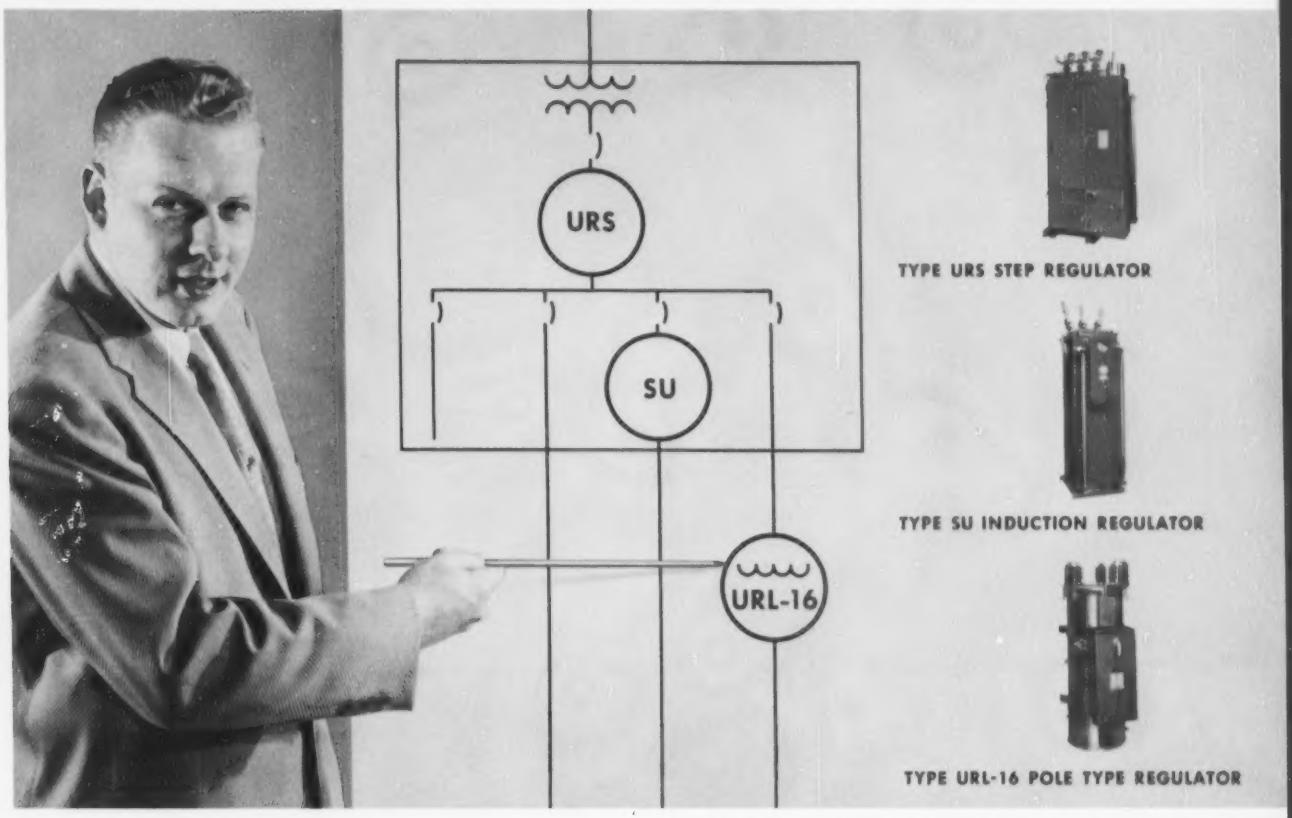
For 5.2-kv service, there are three ratings for one box: EA-50, the standard 50-amp, 1200-amp I.C. cutout . . . HC-50, a high-capacity 50-amp, 5000-8000 amp I.C. cutout . . . MC-100, a new 100-amp, 5000-8000 amp I.C. cutout. These three ratings are available in both dropout and non-dropout types. And there's a 100-amp disconnect blade. *Seven interchangeable doors—one porcelain box.* Equivalent number of ratings available for 7.8-kv service.

You can count on these additional benefits with Westinghouse enclosed cutouts: Exclusive Prestite® porcelain process insures proper fit of doors. Fewer joints in the current path mean less heating, less corrosion and longer life. On dropouts, the door swings through 180° for greater visibility and safety.

Complete facts are in DB 38-610. Write for it.

YOU CAN BE **SURE**...IF IT'S

On the line or in the substation . . . these regulators cut costs, improve service



Al Cleveland, Regulator Sales Engineer, with a single line diagram showing regulator applications.

The complete line of Westinghouse regulators makes it possible for you to apply either step or induction types to meet specific requirements throughout your distribution system.

Very important in meeting growing loads is the URL-16—pole-type step regulator. This advanced 16-step regulator with its exclusive "inverse integrating" voltage regulating relay assures you *the closest effective bandwidth possible in any step-type regulator.* And it does it with fewer operations and simpler construction—for long contact life and minimum maintenance.

For station regulation, the SU induction regulator has proved its superiority with pin-point accuracy and absolutely minimum maintenance. SU "all-electric" control assures Class 1 accuracy and eliminates mechanical control adjustments. Just turn knobs on the convenient control panel.

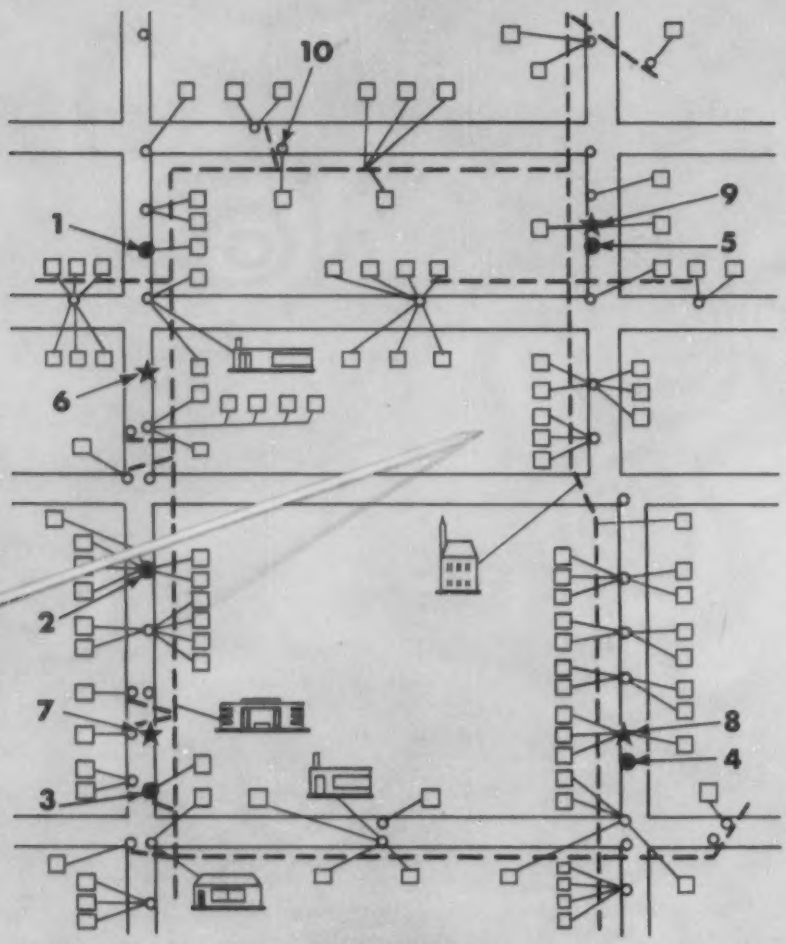
Also for station regulation, the all-new URS is the most accurate, most compact, station-type step regulator you can install. A lifetime Class 1 "all-electric" control and separately compartmented, easily accessible tap-changer contacts are just two of the many features you should investigate if your load problems require the best station regulation.

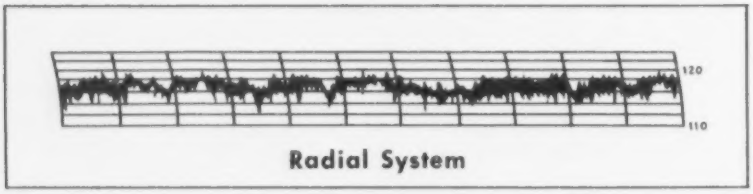
In fact, wherever you want the best regulators, at no extra cost—to meet your specific load requirements—look to the complete Westinghouse line. Booklet B-6053 with complete product details and application data is available from your local Westinghouse representative.

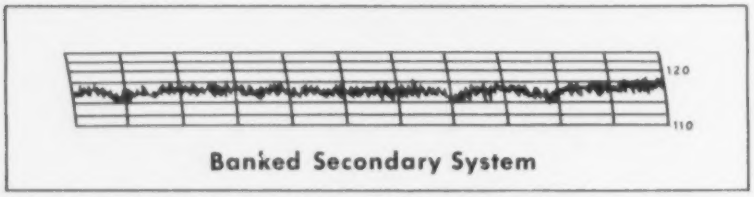
On the next two pages Bob McCollom of the Transformer Division talks about transformers and banked secondaries in residential areas.

Westinghouse

LOCATIONS OF TRANSFORMERS
(CONVENTIONAL AND "CSPB")







R. N. McCollom, Sales Manager, Transformer Division, points out utility test area with conventional transformers at locations 1, 2, 3, 4 and 5. These were replaced with "CSPB" transformers at 6, 7, 8 and 9. Instantaneous voltage dips at location 10 were recorded before and after "CSPB" transformers were installed. A 45% reduction was achieved.

BY ACTUAL TEST,

"CSPB"® transformers provide for load growth . . . improve regulation at lower cost

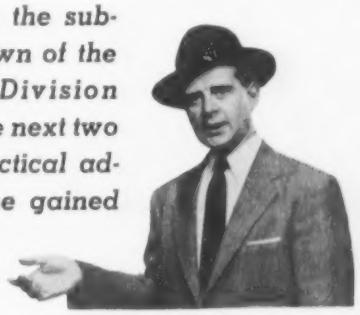
Actual tests conducted on well-defined load areas have proved the inherent superiority of the "CSPB" banked secondary system in handling growing residential loads . . . while improving voltage conditions at less cost.

The test area selected had five conventional transformers totaling 55 kva, serving 106 residential and five commercial customers. A survey of major appliances in use indicated that considerable load growth could be anticipated. Existing load and voltage conditions were recorded over a period of two months.

Following this, the five conventional transformers were replaced by four 15-kva "CSPB" units. Again, load and voltage conditions were recorded over a period of five months. The findings are tabulated in the load data table, below.

The result? Average voltage conditions were improved by 7% . . . with far less capacity than would have been required to make the existing radial system adequate. In addition, all of the benefits of "CSPB" construction were realized. For further information, write for booklet B-4310A which contains complete data for your application.

Moving back to the substation, Roy Brown of the Transformer Division points out, on the next two pages, how practical advantages can be gained there, too.



YOU CAN BE **SURE**... IF IT'S **Westinghouse**

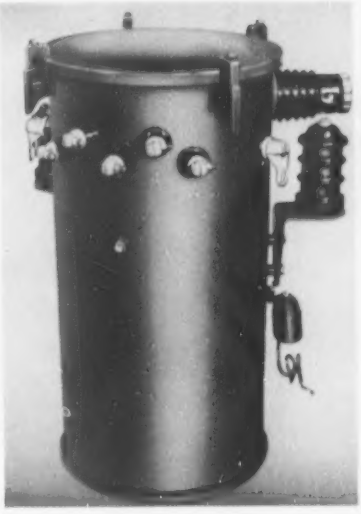
FOR RADIAL SYSTEM

Transformer No.	Kva Rating	Individual Load Peaks Kva	%	Transformer Loads at Time of Peak Load for System Kva	%
1	7½	11.04	147	8.40	112
2	10	12.96	130	11.52	115
3	7½	18.72	249	8.40	112
4	15	18.00	120	14.64	98
5	15	18.00	120	17.28	115
Tot. 5	55	78.72	147	60.24	110

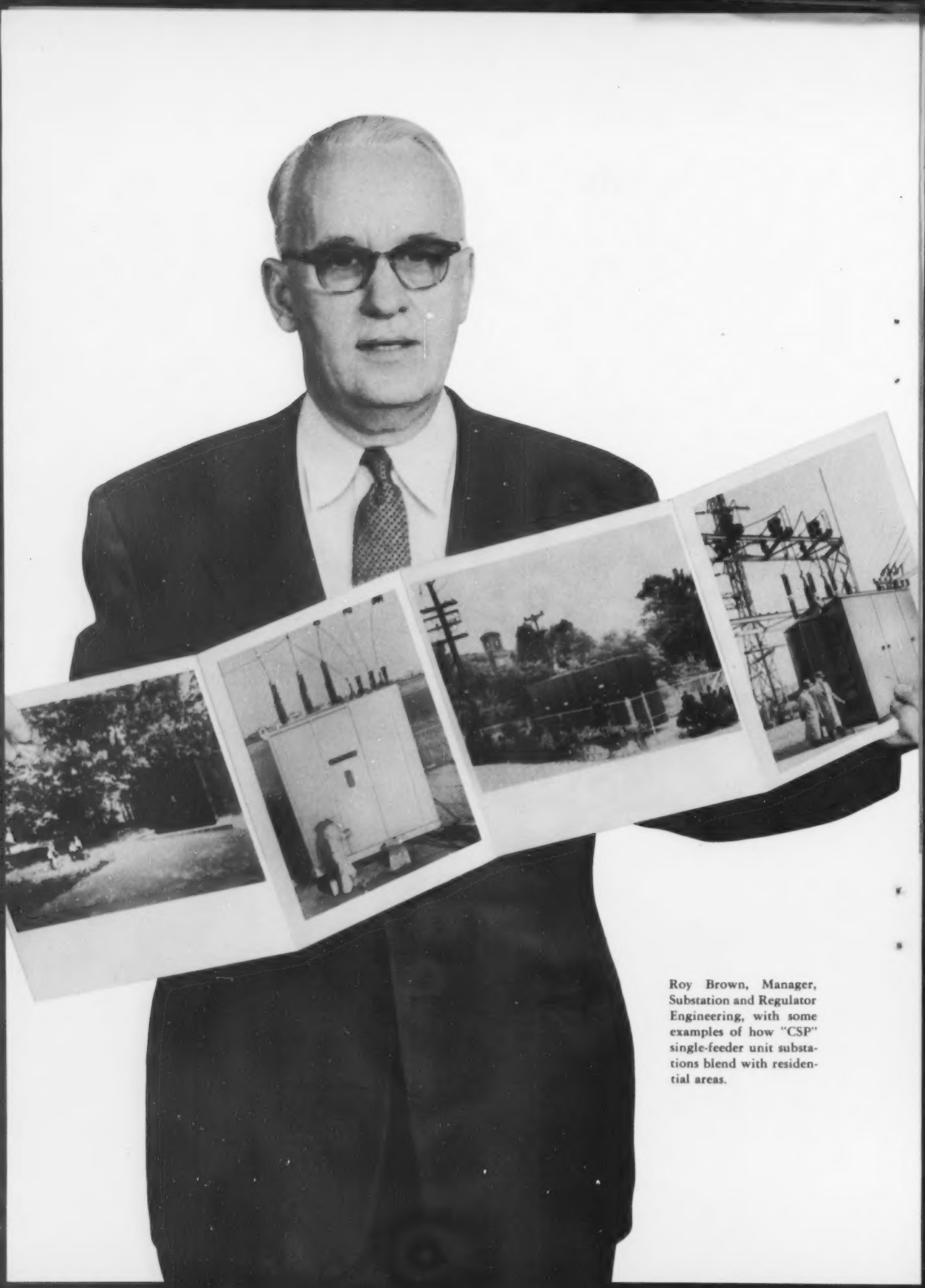
FOR "CSPB" BANKED SECONDARY SYSTEM

Transformer No.	Kva Rating	Individual Load Peaks Kva	%	Transformer Loads at Time of Peak Load for System Kva	%
1	15	17.28	115	14.88	99
2	15	17.76	118	17.28	115
3	15	15.84	105	15.84	108
4	15	15.84	105	14.40	96
Tot. 4	60	66.72	111	62.40	104

Peak load data table shows more uniform load distribution in banked secondary system. Same load growth on radial system would have required much more than the 5 kva added with "CSPB" transformers.



"CSPB" distribution transformer for banked secondary system has built-in lightning, short circuit and overload protection. A system of "CSPB" transformers cannot cascade.



Roy Brown, Manager, Substation and Regulator Engineering, with some examples of how "CSP" single-feeder unit substations blend with residential areas.

Flexible substation . . . makes a good neighbor

For single-feeder substations—in residential areas—the Westinghouse "CSP"® power transformer is a logical choice because of these significant points:

Residential Acceptance — Because the "CSP" power transformer is compact, attractive, quiet and safe, it makes a good residential area "neighbor". You can locate substations to achieve best system efficiency—with less likelihood of objections arising from residential or commercial restrictions.

Factory Coordination—You place a single order and get in one compact unit, a complete single-feeder substation with the 43 components of a conventional substation built in, coordinated and tested at the factory. You eliminate all the time-consuming shipping, expediting and installation coordination necessary with conventional substations.

Simplified Installation—The "CSP" power transformer requires a minimum of real estate . . . and only one foundation. Unload it—tie in transmission and feeder lines and it's ready to go—with complete lightning, surge and fault protection, automatic voltage regulation, load switching and metering. Site-erected substation installation time is reduced 4 to 1. Landscaping is made easy.

When loads are increasing, additional "CSP" power transformers can be easily added. When loads shift, they can be easily and economically moved—with full salvage value. Booklet B-4692 includes still more advantages. Write for it.

On the next two pages Herman Barsun of the Transformer Division discusses substation regulation in relation to your residential load problem.

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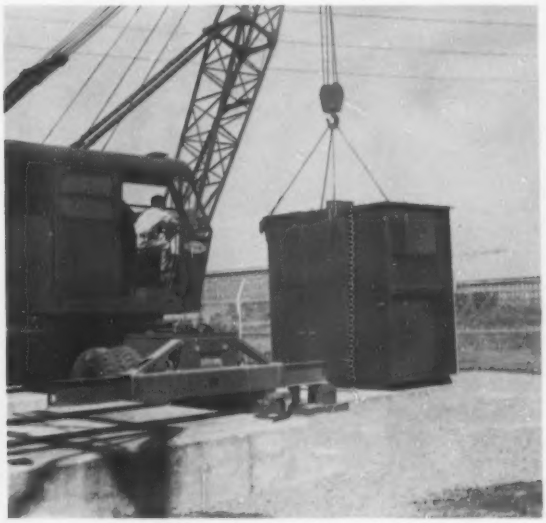


Installing a "CSP" single-feeder substation is a simple process because it is delivered *complete* in one shipment. Unload it—tie in transmission and feeder lines—and it's ready to go.

Herman Barsun, Section Manager, Regulator Section, Transformer Engineering, exhibits the compact orderly construction of the new URS load tap changer.

Consumer satisfaction demands accurate substation regulation

Well-regulated utilization voltage at your customer's service entrance depends on accurate and reliable regulation at the substation level. Whether you are considering "CSP" power transformers, unit substations or standardized power transformers, the URS load tap changer assures you not only accurate and dependable voltage regulation but *quiet* operation as well.

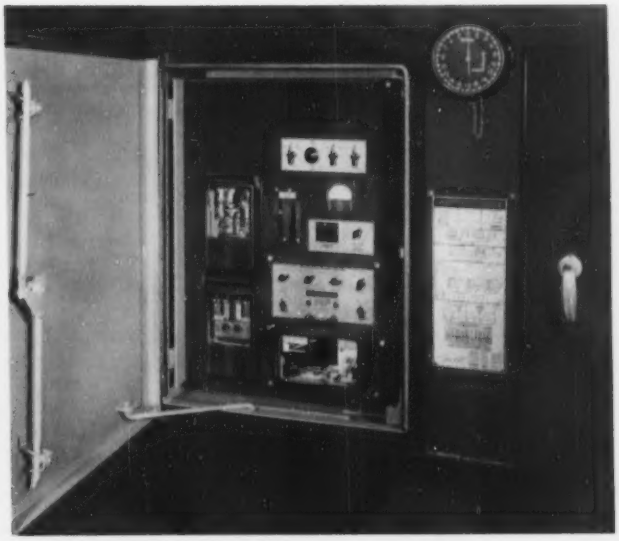
Contributing to both quiet and dependable operation, the Geneva gear drive is the heart of the URS operating mechanism. Contacts move at the optimum speed to prevent burning, yet are accelerated and decelerated smoothly for shockless operation.

You will also appreciate the improved appearance of the new URS housing. The control cabinet is an integral part of the tap changer, resulting in minimum size and weight. All control devices are mounted on a hinged steel panel assuring maximum convenience for operation and maintenance.

The control cabinet contains the new SJS voltage regulating relay. Simple, dial-operated, all-electric settings eliminate mechanical adjustment devices. Hinge-spring construction eliminates pivots and bearings. Factory sealed—not even contact dressing is needed.

Your local Westinghouse representative will be glad to discuss further details of the new URS load tap changer with you.

YOU CAN BE SURE...IF IT'S Westinghouse



Hinge-mounted for easy accessibility, the integral control panel includes SJS voltage regulating relay, time delay relay, motor control relay, and manual control provisions. Operation and maintenance are simplified.

Complete SJS voltage regulating relay is mounted with four bolts and wired through plug-type connectors for ease of routine testing. All-electric settings eliminate mechanical adjustment devices.

D. N. Reps of Electric Utility Industry Engineering worked out the hypothetical equivalent system that solved this particular problem.

"Equivalent systems" analysis solves feeder-voltage problems

"A medium-sized city in the midwest faced a problem that is becoming increasingly common as more homes 'go electric'.

"It was apparent that the present 2400-volt feeders would soon be overloaded, and the utility was concerned about regulation and outages that could result in loss of goodwill, as well as revenue.

"Together with the utility engineers, we went over the problem in detail, even surveying the area to determine geographical and physical factors. Armed with this information, we took the problem to the Distribution Engineers at East Pittsburgh for solution by the unique method of constructing a hypothetical equivalent system. Thus, comparable voltage levels and substation ratings could be checked, yielding results applicable to the actual system.

"The results of this study clearly showed that optimum economic design could be achieved by changing over to 4160 volts. The utility is now in the process of making the change-over . . . ample proof that they were pleased with the study."

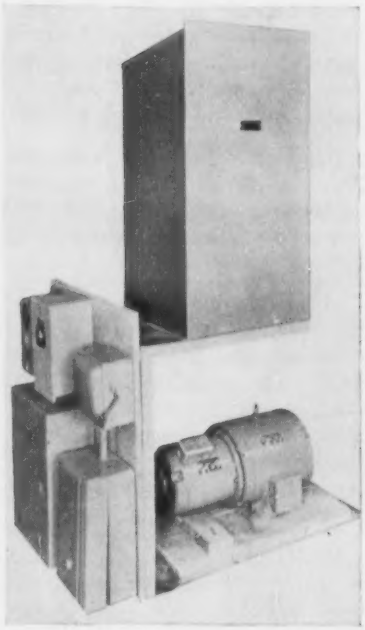
These and many other facilities, backed up with broad Westinghouse experience, are available to you, around the clock. For any generating, transmission or distribution problems you might encounter, resources like these are priceless. CP-1022

For additional information or literature on any of the products discussed on the preceding pages, contact your local Westinghouse representative, or write direct to Westinghouse Electric Corporation, 3 Gateway Center, P.O. Box 868, Pittsburgh 30, Pa.

YOU CAN BE **SURE**... IF IT'S Westinghouse

New Equipment

(*Continued from page* 166)



amplifer to detect the signals. Only moving part is the heavy-duty load relay. Peak-Trol is claimed to operate over practically any distance and control an unlimited number of water heaters.

Control Corp, 718 Central Ave, Minneapolis, Minn.

Stone-Lined Water Heater

Electric water heater is stone-lined for long life in the New England area. Inside of tank is lined with at least ⅜-in. rust-proof hydraulic stone for protection against corrosive properties of the water. Thermostats can be set to deliver water from 120 to 170 F. Tanks use Corox direct immersion heating elements and Fiberglas insulation. Models available are for 52 gal (EG52-C2), 66 gal (EG66-C2), and 80 gal (EG80-C2).

Westinghouse Electric Corp, 246 East Fourth St, Mansfield, Ohio

Electric Oven

Universal electric oven with a temperature range of 200 to 1,000 F is suitable for annealing, baking, brazing, curing, heat treating, normalizing, paint testing, processing, soldering, etc. A selector switch gives high, low, or medium heat.

A 10-in. recirculating fan is located in the roof of the oven. The interior is all stainless steel. Exterior dimensions are 34 x 46 x 64 in. Oven interior is 24 x 22 x 24 in. Shelves are adjustable. Input is 220 or 440 v.

Steiner-Ives Co, 301 Springfield Ave, Union, N. J.

Heating Unit

Heating unit for production lines provides a wide temperature range and close heat control tolerances. Units are suited for application of intense heat on a moving conveyor such as paper, tape, plastics, bondings, resin-impregnated products, etc. They use Calrod heaters with a range up to 1,500 F.

Temperature control uses the GE Reactrol system which varies the applied power in accordance with the predetermined need. The control, actuated by a thermocouple, assures stepless, non-varying heat.

McCreary Machine Works, Cohoes, N. Y.

Fluorescent Fixture

Reduction of room noise plus high level illumination is combined in Sono-Lume fluorescent lighting fixtures. The sound control element consists of blankets of preformed glass fibers behind perforated steel wings. Fixtures are designed for continuous-row installation with a maximum center-to-center spacing of 6 ft. Length is 4 or 8 ft. For complete diffuse illumination they use all-plastic shielding. A louver assembly having a 35-deg crosswise and 45-deg lengthwise shielding may be used. Light-reflecting surfaces have 86% minimum reflectance.

Sylvania Electric Products, Inc, 1740 Broadway, New York 19, N. Y.

HANDY ANDY SAYS,

DUXSEAL®

plugs 'em easier-and better!

Duxseal is a nonhardening adhesive plastic compound made with an asbestos base. Stays plastic, will not slump, melt or run under ordinary temperatures. Clings to duct walls and cables but flexes with expansion and contraction. Unaffected by water and gases—does not react with rubber, metals or painted surfaces. For full details write Johns-Manville Box 60, New York City 16; in Canada, 199 Bay St., Toronto 1, Ontario.

Duxseal is a general utility sealing and caulking compound for duct openings, pothoads, bushings and terminal boxes. Use like putty as it comes from the package

JM

Johns-Manville
SEALING COMPOUNDS

"FEDNEWS" PHOTO

Let There Be Light-

Sorry — we're out of business today, and for many days. We've been forced to cut "interruptable" customers. Total loss in fire damage and power may exceed 10 million dollars.

Here's what happened. Fire started in a circuit breaker and spread throughout the building. The roof crashed down. Giant steel beams sagged like ribbons. Concrete walls fell into the machinery. Engineers and repair crews are restoring our power output, but it will take time and plenty of money.

Moral: Prevent damage to equipment and interruption of power service with ENGINEERED "Automatic" FIRE PROTECTION. It involves analyses of your needs based on the machinery and equipment connected with your operation. Your hazard may best be protected by means of "Automatic" FIRE-FOG, AIR FOAM, CO_2 or a combination of these extinguishing mediums. The need is dictated by the degree of hazard, the demand for personnel safety, the high value of equipment, the requirements for uninterrupted business operations.

Learn how ENGINEERED "Automatic" FIRE PROTECTION can safeguard your plant — save you dollars while doing it. Mail the coupon for FREE descriptive literature.

"Automatic" Sprinkler Corp. of Amer.
Youngstown, Ohio

Please rush copy of Bulletin 64 — Design and Application of "Automatic" FIRE-FOG

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"Automatic" Sprinkler
CORPORATION OF AMERICA
YOUNGSTOWN, OHIO
Offices in principal cities of North and South America

MORE NEW PRODUCTS

about which you should know

Truck-Crane, Inc, 130th & Halsted St, Chicago 27, Ill., has self-contained materials-handling **crane** for trucks, rated 5,000 lb, with 280 deg, 16-ft radius boom and traveling carriage.

Executone, Inc, 415 Lexington Ave, New York 17, has industrial **paging system** also usable as a two-way or party-line telephone for fast paging and answering.

Holub Industries, Inc, Sycamore, Ill., has 8 7/8-in. dia **fish tape** reel and puller with 100 ft of 1/8 x 0.045-in. tape . . . Technical Devices Co, 2350 Centinela Ave, Los Angeles 64, Calif., has Mark I semi-automatic wire **cutter and stripper** which strips both ends of wire in one operation and is air-powered.

Dalco Manufacturing Co, Inc, 333 N. 3rd St, Philadelphia 6, Pa. has fused **outlet box** with T-slot duplex receptacles, 8-ft cord, and ground terminals.

Wassco Electric Products Corp, 126 W. Cass St, Joliet, Ill., has **resistance soldering** power units, Model 105-B2 and 105-C1, 500 and 1000 w. Switch provides 24 heats; input is 115/230 v, 50-60 cps.

United Transformer Co, 150 Varick St, New York 13, has high-Q **coils** for low frequencies. Q is about 45 at 100 cps and 20 at 20 cps. Type MQL coils are rated from 2.5 to 400 hy.

Gibson Electric Co, 8351 Frankstown Ave, Pittsburgh, Pa., has copper-tungsten **contacts** of Gibsiloy UW-8 for tap changers, starters, and oil-immersed apparatus.

National Radiac, Inc, Newark, N. J., has a light-tight **scintillation counter** for beta particles and insensitive to gamma rays and neutrons, uses stilbene crystal covered by 0.0005-in. aluminum foil.

Ballantine Laboratories, Boonton, N. J., has Model 620 extra-high-voltage **multiplier** for measuring 60 kv peak ac, ratio is 10,000:1, accuracy is 2% from 60 cps to 6 Mc, input is 3.8 uuf and 10^{12} ohms.

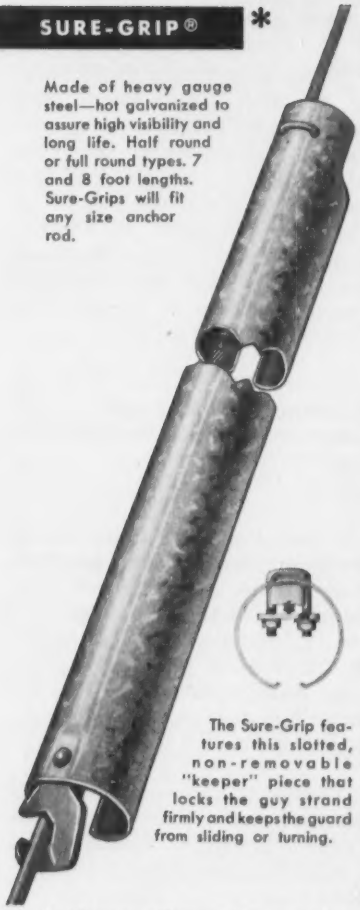
Make Guys safe with

CHANCE GUY GUARDS...

a type for every installation

SURE-GRIP® *

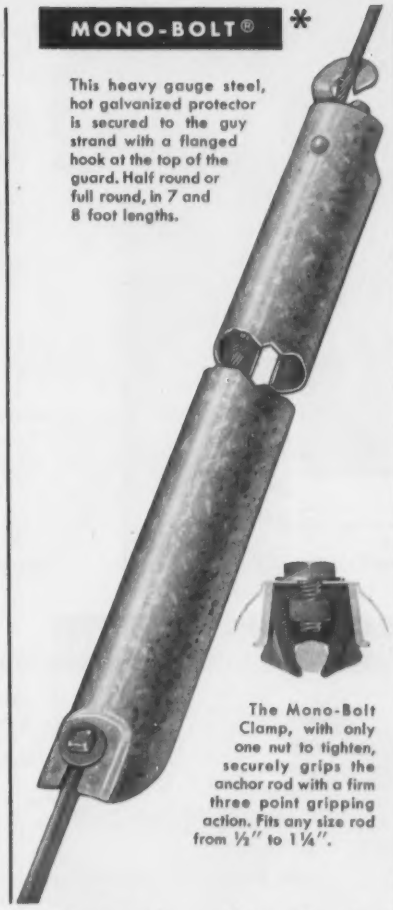
Made of heavy gauge steel—hot galvanized to assure high visibility and long life. Half round or full round types. 7 and 8 foot lengths. Sure-Grips will fit any size anchor rod.



The Sure-Grip features this slotted, non-removable "keeper" piece that locks the guy strand firmly and keeps the guard from sliding or turning.

MONO-BOLT® *

This heavy gauge steel, hot galvanized protector is secured to the guy strand with a flanged hook at the top of the guard. Half round or full round, in 7 and 8 foot lengths.



The Mono-Bolt Clamp, with only one nut to tighten, securely grips the anchor rod with a firm three point gripping action. Fits any size rod from ½" to 1¼".

MATTHEWS †

These half round guards save a lot of space on trucks and in storage, because they nest together. Matthews Guards are exceptionally strong—made of galvanized steel. Available in 7 and 8 foot lengths.

The patented upper clamping member is an integral part of the guard and securely locks on the guy wire. The lower end of the guard fastens to the guy clamp bolt.

Only Chance offers such a complete line of guy guards to meet your installation requirements. The line includes the service proved Sure-Grip, popular with linemen because there is nothing to take apart and re-assemble—no loose parts to lose. More than a million Sure-Grips are in use throughout the country . . . that's proof of the success of this protector.

Another favorite is the Chance Mono-Bolt, standard choice of hundreds of utilities. The Mono-Bolt combines normal guy wire protection requirements—safety, durability, and economy—with a simple installation method.

The Matthews Guy Guard cannot be turned or twisted on the guy wire. These one piece protectors are designed to cover the guy rod and wire to the ground line even if the rod barely extends above the ground.

* *Made by Specialty Devices Company, Subsidiary of A. B. Chance Co.*

† *A product of the A. B. Chance Company Matthews Plant.*

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CGS4-7

What makes a 40-Year Pole?

When it's a Koppers Pressure-Creosoted Pole, like the old-timer shown here, there's a *combination* of reasons which can be summed up by the phrase — "Koppers Quality Control."

Koppers quality control starts right with the timber. Koppers experts approve a purchase only when the timber meets the highest standards of strength and straightness. Then, every other step—machine-peeling, stacking, seasoning, framing, pressure-creosoting—is under the strict supervision of skilled personnel.

Quality control doesn't end with the sale or shipment of Koppers Poles. Koppers "quarrels with success" by carrying on a continuing program of research to make wood do an even better and more economical job for you. In one of the most complete wood-treating laboratories in the world, Koppers technicians conduct exhaustive tests on the prevention of wood deterioration.

In addition to supplying good poles, Koppers makes shipments on schedule. Koppers has many strategically located pressure-treating plants that have ample stocks to satisfy your requirements. Write for prices and further information on Koppers Pressure-Creosoted Poles.

KOPPERS COMPANY, INC.

KOPPERS **PRESSURE-CREOSOTED POLES**

® Wood Preserving Division, Pittsburgh 19, Pennsylvania

Keunen Plastic Corp, Philadelphia, is distributing polyurethane **plastic foam,** Cellopren (Dutch), useful for padding, packing, heat and sound insulation, etc.

Allied International Inc., South Norwalk, Conn., has Model 306 regulated hv dc **power supply.** Output is 2,950-3,750 v dc, ungrounded, 25-60 ma, 0.5% regulation, and 50 mv ripple. Bias output is 0-150 v dc at 10 ma max. Input is 105-125 v, 60 or 400 cps (Bulletin 306).

United Transformer Co, 150 Varick St, New York 3, has a series of **magnetic amplifiers** for servo motor applications. Hermetically sealed. Types MAT handle 2-4, 4-8, 6-12, or 9-18 w on 115-230 v, 400 cps supply . . . Polytechnic Research & Development Co, Inc, 202 Tillary St, Brooklyn 1, N. Y., has Type R6G10W1 **magnetic amplifier** for 60 cps supply. Output is 10 w.

Ultra-Violet Products, Inc, 145 Pasadena Ave, South Pasadena, Calif., has Model 3X-4 Blak-Ray **black-light unit** for fluorescent analysis and inspection.

Atomic Center for Instruments & Equipment, Inc, 489 Fifth Ave, New York 17, has Atomlab Model A-65 introductory **scaler** for geiger counters . . . Hazatrol Corp, 215 Market St, San Francisco, Calif., has a power-press **safety control,** Type HC, operated by radioactive wristbands worn by the operator.

Electro-Measurements, Inc, 4312 SE Stark St, Portland 15, Ore., has Dekabox ac **decade resistance box,** 1-1,199,999 ohms (Catalog Sheet).

Holophane Co, Inc, 342 Madison Ave, New York 17, N. Y., has No. C-824 corridor **lighting unit** (Engineering Data Sheet) . . . Hobby & Brown Electronic Corp, 55 Front St, Rockville Centre, N. Y., has Model 200X automatic **emergency light** with 100-amp 6-v lead-acid battery and two 5,000-cp sealed-beam lamps.

Eaton Manufacturing Co, Kenosha, Wis. has line of combination power and **speed control** units for fractional-horsepower drives using constant-speed induction motors, eddy-current couplings, and electronic speed controls.

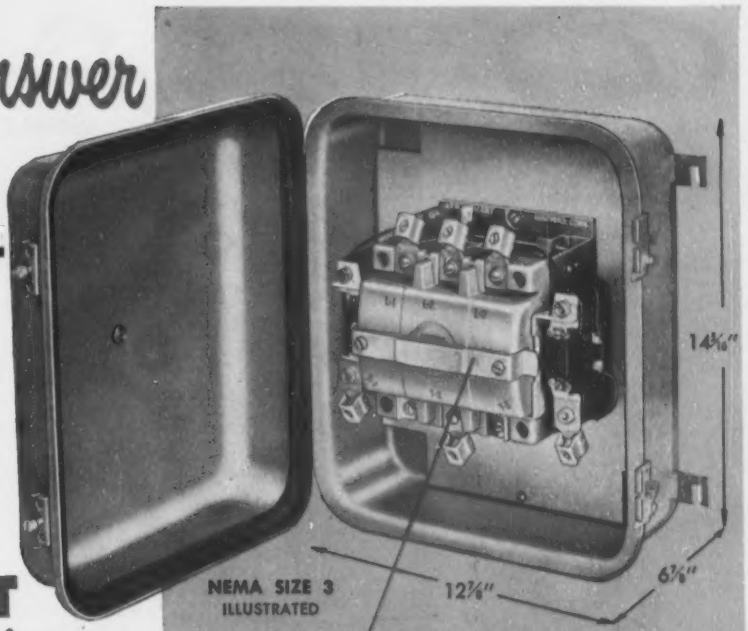
The Right Answer

TO YOUR MOTOR CONTROL "Housing" PROBLEMS

ARROW·HART

INDUSTRIAL-USE Enclosures

(NEMA TYPE XII)



NEMA SIZE 3
ILLUSTRATED

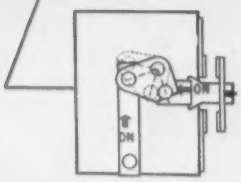
Developing this new line of NEMA XII Enclosures, Arrow-Hart worked in close cooperation with leading Industrial Engineers throughout the country. Their recommendations have helped us make these the finest enclosures ever offered for use in those industries where it is desired to exclude such materials as dust, lint, fibres and filings, or oil and coolant seepage. Teamed with Arrow-Hart Type "RA" Magnetic Motor Starters, they assure the superior electrical performance that will help all machines realize their full productive efficiency.

Features . . .

- BALLOON TYPE IMPRESSION GASKET . . . of heavy neoprene effectively seals out oil.
- RUGGED CONSTRUCTION . . . of heavy, seamless drawn steel. Hinged cover is more convenient, can't be dropped, provides superior alignment with even pressure all around for a complete seal.
- AUTOMATIC LATCHES . . . hold cover securely even if locking screws are accidentally left loose.
- NO KNOCKOUTS . . . with no possibility of accidental removal or loosening of unused knockouts . . . and, thereby, no possibility of admitting breakdown materials. Plenty of room in enclosure makes it easy to drill for top or bottom entrance.
- REMOVABLE MOUNTING PLATE . . . makes it easy to remove starter from enclosure by merely loosening 2 non-removable screws.

Available . . . IN NEMA XII

- ACROSS-THE-LINE SIZES 0, 1, 2 and 3
- REVERSING AND TWO-SPEED SIZES 0, 1 and 2
- COMBINATION STARTERS . . . SIZES 0, 1 and 2



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Arrow-Hart Type "RA" Starters feature a completely new, radically different operating mechanism. Working through a bellcrank lever linkage, the much smaller magnet gains added leverage and easily outperforms old-fashioned, direct-acting types. Here are some of the important benefits made possible by this first real advance in motor control design in over 25 years . . .

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- STRAIGHT-THRU FRONT WIRING
- ALL CONTACTS EASILY ACCESSIBLE FROM THE FRONT
- POSITIVE UNDERVOLTAGE RELEASE
- SUPERIOR ARC SUPPRESSION

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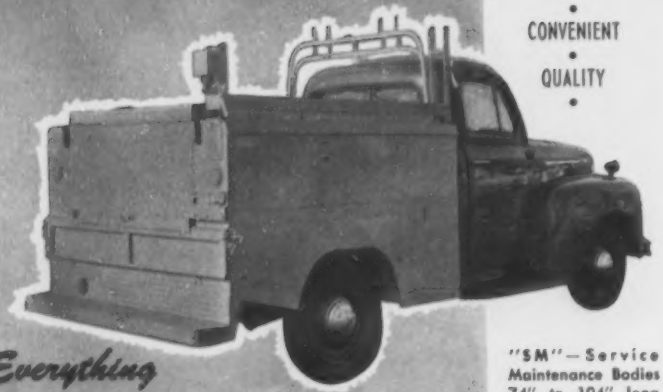

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"TT"—Transformer Trailer is one design of many for installation of transformer and circuit power. Transformer Trailers provide added capacity to restore service when secondary breakers trip repeatedly or transformers overload. This ingenious arrangement simplifies change-outs with fast service, anywhere.

"CPT"—Cargo Pole Trailers of many designs and capacities. Single, dual and four wheel trailers built to your specifications.

Send us your specifications and body design and we will build it for you.

Write for complete information.

AUTO BODY WORKS, Inc.

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TECHNICAL LITERATURE

ORGANIC CHEMICALS—Bulletin 4-03 (C-39-6), 10 pages, covers Palcotan and Palconate. These are reactive chemical products derived from redwood bark and contain a high percentage of phenolic acids. Palconate is the sodium salt of these organic acids. Palcotan is the sodium salt of sulfonated organic acids. Uses include boiler water treating compounds, battery expander, electroplating, tanning, and a phenol replacement. Pacific Lumber Co, 100 Bush St, San Francisco 4, Calif.

SOLVENT SAFETY—A 4-page pamphlet, An Approach to Solvent Safety, gives suggestions on selecting solvents for use in the electric power industry. John B. Moore Corp, P O Box 3, Nutley 10, N. J.

RELAYS—An 84-page book publishes all papers presented at the symposium on electro-magnetic relays given at Oklahoma Institute of Technology, Stillwater, Okla, Feb 23-26, 1954. Potter & Brumfield, Princeton, Ind.

FLOW METERS—Catalog 2320, 56 pages, describes indicating, recording, integrating, and controlling flow meters. Minneapolis-Honeywell Regulator Co, Wayne & Windrim Ave, Philadelphia 44, Pa.

WESTINGHOUSE BULLETINS—Following are available from Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.:

B-6053 A Full Line of Voltage Regulators for Pole and Station Applications—18 pages

B-5878 Micarta Data Book—50 pages. Covers properties of Micarta laminated and molded plastic.

STAINLESS STEEL WELDING ELECTRODES—Bulletin WE-166 (24 pages) catalogs electrodes for welding stainless steel, includes an electrode selector table, and tabulates material on welding processes. A. O. Smith Corp, Box 584, Milwaukee 1, Wis.

ZIRCONIUM—Facts About Zirconium (68 pages) covers complete chemical, physical, and metallurgical properties of this metal. Characteristics of interest to refractory and atomic applications are its low neutron absorption and high corrosion resistance. Carborundum Metals Co, Inc, Akron, N. Y.

WATER CONDITIONING—Water Conditioning Data Book No. 2478A (116 pages) is available to practicing engineers and those who work with water conditioning problems. Tables and 78 chapters cover hydraulics, impurities in water, chemical conversions, coagulant and acid and alkali dosages, chemicals used, processes, boiler feed make-up, alkalinity, specific gravities, chemical reactions, hydraulic conversion factors, useful tables, etc. Leatherette, gold-imprinted volume is 5 x 7¼ in. The Permutit Co, 330 W. 42 St, New York 36, N. Y.

STEAM TURBINE HISTORY—Booklet O3R8145, Steam Turbine History Highlights, 22 pages, by R. C. Allen, is reprinted from the Allis-Chalmers Electrical Review. It tells of the first practical steam turbine applications and concludes with developments which have helped increase engine efficiency from less than 60% in 1900 up to the middle 80's at the present time. Allis-Chalmers Manufacturing Co, 932 S. 70 St, Milwaukee 1, Wis.

VIBRATION CONTROL—Shock and Vibration Control Notes, a house organ, originated in June issue and is published quarterly. It is devoted to shock, vibration, and noise isolation. Information will be included not available in trade publications. Barry Corp, 700 Pleasant St, Watertown, Mass.

Dependable

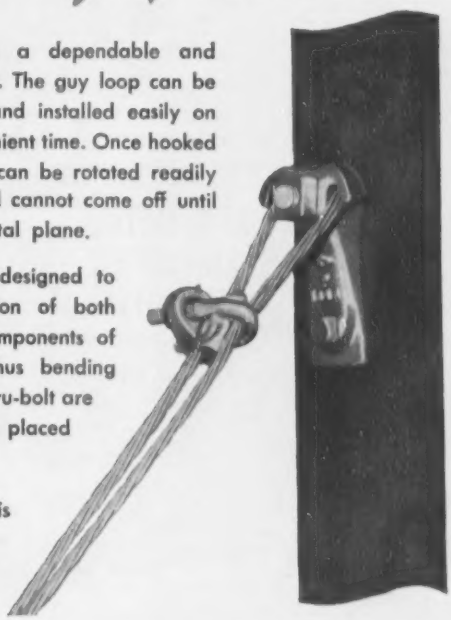
M|F GUY HOOKS

Never let a guy down!

Loop securely retained.

Guy at any angle up to 90° with pole.

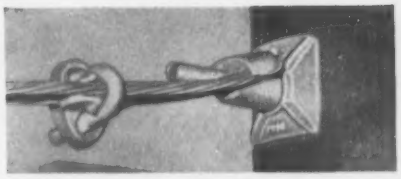
- **M.I.F. Guy Hooks** are a dependable and economical guy attachment. The guy loop can be made up on the ground and installed easily on the Guy Hook at any convenient time. Once hooked over one of the "ears", it can be rotated readily into its proper position and cannot come off until again turned to a horizontal plane.
- **M.I.F. Guy Hooks** are designed to transmit a large proportion of both vertical and horizontal components of the load to the pole. Thus bending and shear stresses on the thru-bolt are minimized and the bolt is placed chiefly in tension.
- **Each M.I.F. Guy Hook** is a single malleable iron casting, hot dip galvanized.



Wedge resists vertical movement; permits high- or initial tension on thru-bolt.

Spurs add to vertical stability.

Light duty Guy Hook for down, span and arm guys. Also a House Bracket. Reduces inventory.



P137 Series for dead ending arm and head guys, and messengers, at any angle to 30° with the horizontal.

Channel back provides better fit on poles.

Wide heel pad provides maximum resistance to overturning.

SPECIFICATIONS

Cat. No.	Maximum Bolt Dia.	Maximum Strand Dia.	Thimble Dia.	Approx. Shipping Wt. Lbs./C.
Guy Hooks				
PX85	⅝"	⅜"	1⅜"	45
P135A	⅝"	7/16"	1⅜"	110
P133A	¾"	½"	1⅝"	136
P132C	¾"	¾"	2⅝"	275
P132B	1"	¾"	2⅝"	275
Span Guy Hooks				
P137	① ⅝"	½"	1⅝"	69
P137A	② ⅝"	½"	1⅝"	70
P137B	② ¾"	½"	1⅝"	68
P137C	① ¾"	½"	1⅝"	67

① Clearance hole. ② Tapped hole.

MALLEABLE IRON FITTINGS CO.

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Representatives: William J. Cottrell Co., Portland, Ore. • James H. Drew Corp., Indianapolis, Ind. Industrial Engineering & Equipment Corp., Los Angeles, Cal. • JSG Electric Co., Chicago, Ill. B. H. McCain, Knoxville, Tenn. • E. A. Thornwell, Inc., Atlanta, Georgia • J. P. Voight, Summerville, S. C. Waltham, DeWitt & Krusi, San Francisco, Calif. • L. G. Wendegatz, Kansas City, Mo. Williamsen Sales Co., Shreveport, La. • O. C. Witte Co., Detroit, Mich.

LIGHTNING PROTECTION FOR ELECTRIC SYSTEMS

Just Published!

Practical guide to protection against lightning of electric systems and equipment. Shows nature and effects of lightning, particularly for ac systems and apparatus, how to select and apply arresters, what conditions to look for to avoid trouble. Simple treatment holds mathematics to a minimum. Includes practical recommendations for protective measures, information on grounding, shielding by rods, masts, shield wires, uses, performance, and construction of arresters. **By E. Beck, Mgr. Lightning Arrester Section, Westinghouse. 310 pp., 149 illus., $6.50**

MAGNETIC-AMPLIFIER CIRCUITS

Just Published!

This practical treatment of fundamental principles, characteristics, and applications logically develops the various kinds of basic and more complex magnetic amplifier circuit arrangements without extended mathematical considerations. Descriptive and graphical methods are used to give qualitative and quantitative interpretation of essential facts. Material is systematically classified according to circuit functions so you can compare and select solutions best suited to your special problem. **By William A. Geyger, U. S. Naval Ord. Lab. 277 pp., 135 illus., $6.00**

THE LINEMAN'S HANDBOOK

That transmission line fact you want is in this handy guide giving principles, data, methods, and cautions on all aspects of the lineman's work. Describes all the materials of line construction: poles, conductors, hardware, tools, electrical apparatus, etc. Comprehensive section on safety covers precaution methods, first aid, and individual prevention measures. Information on construction, testing and maintenance shows how to meet problems with right choice of materials and methods. **By E. Kurtz, U. of Iowa, 2nd Ed., 652 pp., 682 illus., $7.00**

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This offer applies to U. S. only. W-8-23

CATALOGS • BULLETINS

● **ANCHORS:** A 12-page catalog covers a line of anchoring devices for fastening equipment to plaster, stone, brick, wood, or concrete. Rawplug Co, 271 Church St, New York, N. Y.

● **COOKING:** Catalog C-10, 24 pages, covers Akron commercial cooking equipment—ranges, broilers, griddles, ovens, fryers, hotplates, steamers, marine equipment, etc. Associated Products, Inc, 20 S. Ontario St, Toledo 2, Ohio

● **MATERIALS HANDLING:** Booklet 2008-K, 12 pages, covers overhead materials handling equipment. Cleveland Tramrail Div, Cleveland Crane & Engineering Co, Wickliffe, Ohio.

● **POWER COMPONENTS:** The 1954 Component Parts Catalog, GEC-1025, 100 pages, covers circuit breakers, disconnect switches, open knife switches, panelboard component parts, etc. General Electric Co, Trumbull Components Dept, Plainville, Conn.

● **CABLE TRAYS:** A 12-page booklet covers standard cable trays and fittings. Fab-Weld Corp, Philadelphia 34, Pa.

● **RELAYS:** A 4-page folder covers miniature relays designed for shock service. Hi-G, Inc, Bradley Field, Winsor Locks, Conn.

● **PLATING RECTIFIERS:** Bulletin 5500, 8 pages, covers selenium rectifier units for electro-plating, cleaning, polishing, forming, typing and anodizing. Ther Electric & Machine Works, 17 S. Jefferson, Chicago 6, Ill.

● **CHAIN DRIVES:** Catalog C72-51, 16 pages, gives capacity ratings of Hy-Vo high-speed, heavy-duty chain drives, up to 190-hp per in. of chain width at speeds up to 6,000 fpm. Morse Chain Co, 7601 Central Ave, Detroit 10, Mich.

● **UNIT HEATERS:** Bulletin 7517, 44 pages, covers Venturafin unit heaters for steam and hot-water applications—features of design, engineering data, capacity tables, and piping diagrams. American Blower Corp, Detroit 32, Mich.

● **GEAR DRIVES:** Bulletin 3100-1954, 32 pages, covers gear drives up through 75 hp, including selection tables, dimensions, weights, etc. Falk Corporation, 3001 W. Canal St, Milwaukee 8, Wis.

● **2-POLE MOTORS:** An 8-page bulletin, 05R8123, Modern Design Two-Pole Motors, 900 hp and larger, discusses auxiliary drive motor design to keep pace with modern power. Allis-Chalmers Manufacturing Co, 932 S. 70th St., Milwaukee, Wis.

● **BATTERIES:** A 20-page booklet, Nickel-Iron-Alkaline Storage Batteries for Industrial Trucks, gives electrical data, weights, and dimensions of all standard Edison battery assemblies for this service. Edison Storage Battery Div, Thomas A. Edison, Inc, West Orange, N. J.

● **TEMPERATURE INDICATION:** Instruction sheet describes uses of Tempilstiks, Tempil Pellets, and Tempilaq. These materials have various melting points in the range of 113 to 2000 F, indicating the appropriate temperature upon melting. Tempil Corp, 11 W. 25th St, New York 10, N. Y.

● **VARIABLE DRIVES:** Bulletin FAS covers fractional-hp adjustable-speed drives. Units are an integral combination of ac constant-speed induction motors, eddy-current couplings, and electronic speed controls. Drives are 115/220 v single-phase or 220/440 v 3-phase; ¼, ½, and ¾ hp at 1,600 rpm, 10:1 constant-torque speed range; ½ and ¾ hp at 3,200 rpm, 20:1 range. Eaton Manufacturing Co, Kenosha, Wis.

● **WIRE TOOL:** Catalog sheet covers the Stripex All-in-One tool used as a sheathing slitter, wire stripper, and cutter for installing electric wiring. Burbank Electrical Products, 215 W. Palm Ave, P O Box 7, Burbank, Calif.

● **SAFE TRUCK OPERATION:** Send Your Cowboys to School, 4 pages, covers do's and don'ts for safe industrial truck operation. Elwell-Parker Electric Co, 4205 St. Clair Ave, Cleveland 3, Ohio

● **OXYGEN ANALYZER:** Bulletin-sheet AD-609 covers use of industrial gas analysis equipment to detect oxygen in oxygen-free metallurgical furnaces. Arnold O. Beckman, Inc, 1020 Mission St, S. Pasadena, Calif.

● **GAS ANALYZER:** Bulletin 501, 4 pages, covers a supersensitive analyzer for detection of hazardous gases in low concentrations. Taller & Cooper, 75 Front St, Brooklyn 1, N. Y.

● **CRANE CONTROL:** Bulletin GEA-6112, 20 pages, covers compact ac crane controls, NEMA Class I through V, cab-operated and floor-operated hoist, bridge, and trolley controls, rated up to 60 hp at 220 v or up to 125 hp at 440-550 v. General Electric Co, 1 River Rd, Schenectady 5, N. Y.

● **SOLENOID VALVE:** Bulletin-page A-2 covers Type A, general-service solenoid valves, 1, 1¼, and 1½ in. sizes, for use from 1 to 500 psi. J. D. Gould Co, 730 East Washington St, Indianapolis, Ind.

● **DATA REDUCTION:** The Ratonews June issue, 4 pages, covers use of Digi-Coder, a multiple pressure readout system, and automatic logging. Fischer & Porter Co, Hatboro, Pa.

● **FLOAT POSITION TRANSMITTER:** Bulletin 170, 4 pages, covers force-balance Rotameter float position transmitter for use with pneumatic receivers and control instruments. Brooks Rotameter Co, Lansdale, Pa.

● **ENVIRONMENTAL TESTING:** Bulletin of 4 pages covers the test services of this laboratory—vibration, shock, acceleration, temperature, humidity, pressure, salt spray, dust. New York Testing Laboratories, 47 West St, New York, N. Y.

● **ELECTROLYTIC CONDUCTIVITY:** Portable indicators for electrolytic conductivity measurements on condensate, soils, etc are covered in 4-page Data Sheet E-95(1). Leeds & Northup Co, 4934 Stenton Ave., Philadelphia 44, Pa.

● **PNEUMATIC CONTROLLERS:** Catalog 53-10 (12 pages) covers stock-type pneumatic controllers for process variables: flow rate, liquid level, viscosity, pressure, temperature, vacuum, etc. Fischer & Porter Co, Hatboro, Pa.

● **GAGING EQUIPMENT:** Bulletin 542 (12 pages) covers electronic gaging equipment for dimensional inspection and control application in tool rooms, gage rooms, and production departments. Cleveland Instrument Co, 735 Carnegie Ave, Cleveland 15, Ohio

● **LEVEL CONTROLS:** Bulletin PF544 (12 pages) covers Probe Fittings Series 67 for liquid level control of conductive liquids. Parts contracting liquid are stainless steel and Teflon. Rating is 250 psi maximum at 300 F. Photoswitch, Inc, 77 Broadway, Cambridge 42, Mass.

● **INDUCTION HEATING:** A 4-page folder covers Kilotron 10 and 20 kw, 400 kc induction heaters. Input is 230/460 v, 50-60 cps, 3-phase. Electric Arc, Inc, 152 Jelliff Ave, Newark 8, N. J.

BOOKS

Received Since August 5

Alternating-Current Machines. 3rd Edition. By A. F. Puchstein, T. C. Lloyd and A. G. Conrad. Published by John Wiley & Sons, Inc, New York 16, N. Y. 721 pages, illustrated. Price $8.50

Electric Traction. By A. T. Dover. Published by Pitman Publishing Corp, New York 36, N. Y. 441 pages, illustrated. Price $12.50

Statistical Theory of Extreme Values and Some Practical Applications. By Emil J. Gumbel. Published by U. S. Bureau of Standards. Distributed by The Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 51 pages. Price 40¢

Nucleonics

The Man in the Thick Lead Suit. By Daniel Lang. Published by Oxford University Press, New York 11, N. Y. 207 pages. Price $3.50

Although the horrors of atomic warfare are exemplified by choice of such terms as "urban depletion" and "megadeaths" the author puts his emphasis on the personalities engaged in the researches. Want to know how we found out what the Germans were doing in the nuclear and rocket fields? What we have ascertained about flying saucers? What the mood is at the bomb tests? Who Goudsmit is and what he has done? Why one scientist after shunning religion has become an active deacon in Oak Ridge? Answers to these matters are told in one of the most human portrayals that has come out of an inhuman quest.

Power Metering

Elektrizitaetszaehler—Tarifgeraete, Messwandler, Time-switches. By P. M. Pflier. Published by Springer-Verlag, Reichpietschufer 20, Berlin W 35. 368 pages, illustrated. Price 36 DM

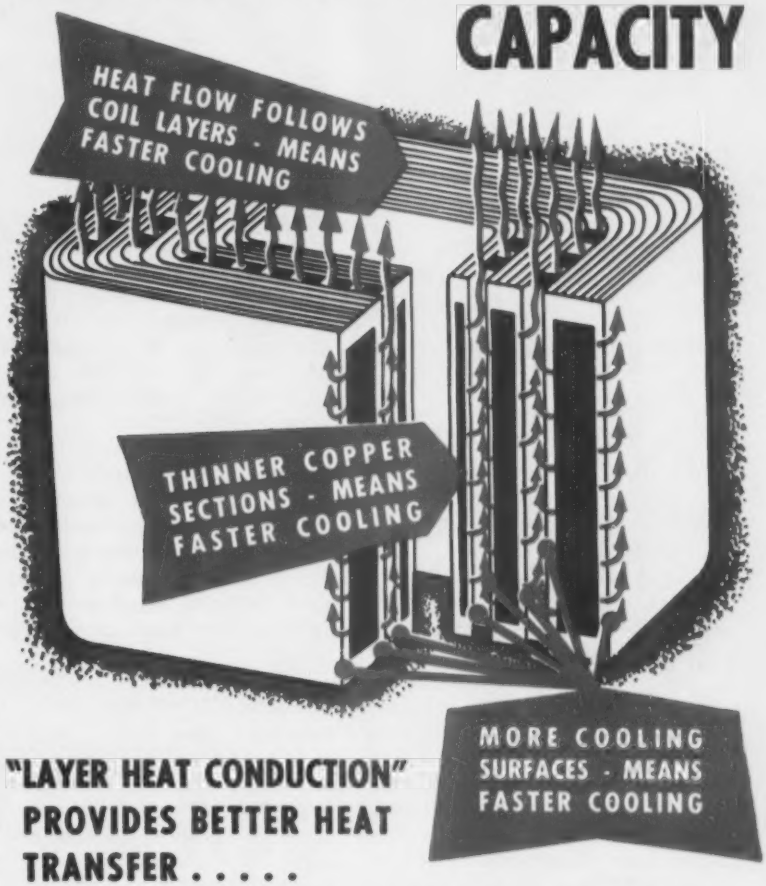
Announced as a book for measurements folk the result meets expectations as a relatively simple development of theory and practice in the field of watthour meters, instrument transformers and time-switches. Preliminary circuit theory is followed by principles of the ac watthour meter and later the dc instrument. The reactive meter is mentioned briefly before moving to tariff meters and remote totalizing. Current and voltage transformers and time-switches complete the treatment. Practically all illustrations and bibliography items are based on European practice and literature.

Instrument Transformers

Die Messwandler. By R. Bauer. Published by Springer-Verlag, Berlin W 35. 313 pages, illustrated. Price 33 marks.

This is a new treatment of instrument transformers from the angles of basic principles, their design development and testing. Techniques, including compensation schemes for current transformers, are dominantly European. This is also true of the designs illustrated and the standard specifications sampled in the appendix.

R T & E transformers have RESERVE OVERLOAD CAPACITY


HEAT FLOW FOLLOWS COIL LAYERS - MEANS FASTER COOLING
THINNER COPPER SECTIONS - MEANS FASTER COOLING
MORE COOLING SURFACES - MEANS FASTER COOLING

"LAYER HEAT CONDUCTION" PROVIDES BETTER HEAT TRANSFER . . . . .

Through extensive research in the study of heat transfer, R T & E engineers have developed a location of oil ducts which more readily conduct heat out of the transformer coil and into the cooling oil. R T & E's oil ducting is based on the principle of "LAYER HEAT CONDUCTION"—that heat generated inside the coils due to inherent copper loss will travel more efficiently around a coil layer than through layer insulation.

Therefore, R T & E's use of more but smaller oil ducts placed at single points adjacent to each layer tends to transfer heat more quickly out of the coil than do the large more sparsely located oil ducts so common in the transformer industry.

This major R T & E development results in reduced coil temperature, the elimination of hot spots, greater overload capacity and longer transformer life.

With "Layer Heat Conduction", R T & E transformers are able to carry loads of 150% for 8 hours without exceeding class A insulation temperature limits.

WRITE FOR CATALOG

R T & E Co.

WAUKESHA WISCONSIN

DEPTHS of 15,000 ft are reached with this Tide Water Associated all-electric rig

Electricity Speeds Oil Drill

. . . all-electric rig combines smoothness, flexibility of dc with convenience of ac to drill for oil in California field

The smoothness and flexibility of d-c variable-voltage control are combined with the reliability and convenience of a-c power supply in an all-electric drilling rig built for Tide Water Associated Oil Co. The new rig was recently installed in the Ventura (Calif.) field and is designed for drilling to depths of 15,000 ft.

The equipment consists of a trailer-mounted, 1,500-kva substation which steps the local 16.5-kv power supply down to 2.3 kv. This voltage level feeds four 380-hp induction motors, which are shaft-connected to four 250-kw d-c, variable-voltage generators. From these generators power is fed to an 800-hp draw-works motor, two 500-hp main mud-pump motors, and one 100-hp mud-mixing pump motor. A control cabinet of weatherproof construction houses all contactors, control switches, relays, meters for d-c generators and motors.

Use of d-c variable-voltage was chosen because it is safe, fast and flexible. The d-c generators may be driven by gas-turbine, diesel or gas engines, or a-c motors. At the Tide Water location, a-c motors are ideally suited because of low power costs, low maintenance, and high over-all efficiency. To protect the hole in the event of a power failure, two 150-hp gas engines are on a standby basis. These engines can provide power to rotate the bit, hoist, or pump mud if necessary.

The 800-hp draw-works motor can deliver 1,340 hp intermittently to the draw works and can develop 225% of full-load torque at stall momentarily. The main motors are shunt wound with marine-type insulation, rated 60-C rise continuous duty, and can be operated continuously at 125% speed.

The 250-kw main generators are of the three-field variable-voltage oil-field type. They have a separately-excited shunt field, a self-excited shunt field, and a differentially-excited series field. Use of these fields gives the generator the most desirable power-transmission characteristics for oil-field application.

The electrical controls at the driller's post consist of the master-control hand wheel, an emergency-stop push button, and a drill-hoist transfer switch. This transfer switch provides convenient selection of power distribution to the various motors for the two basic drilling operations. Power requirements for drilling when the table is rotating and mud is being circulated in the hole usually differ from that needed for entering or leaving the hole. In this latter operation, the hoisting gear requires most of the power.

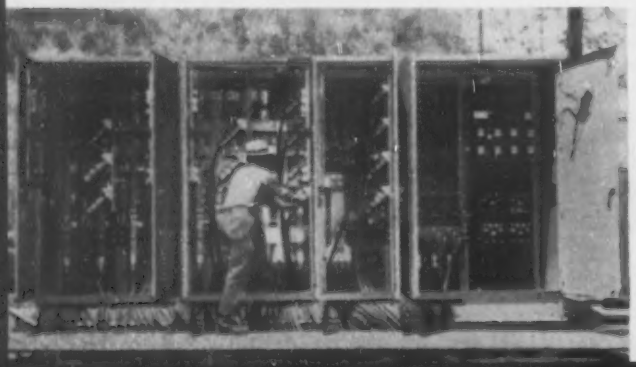
All generator instruments are mounted on the dead-front section of the control board. The motor ammeters are mounted at the driller's post. These give a direct indication of the torque on each motor.

The induction driving motors are line started with oil-immersed contractors mounted on the bedplate between the motor and the generator. Motor feeders are protected by an oil-fuse-cutout switch. The transformer primary is energized through an oil circuit breaker that is manually operated and electrically tripped on severe overloads.

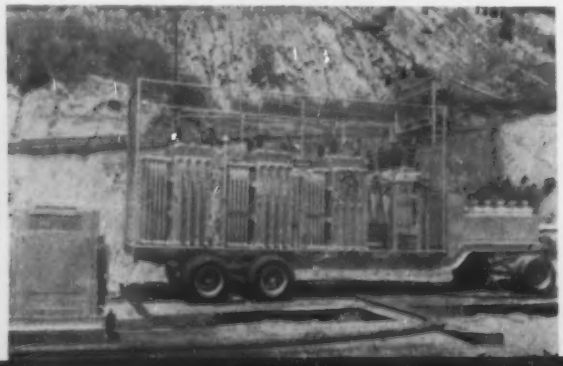
The electrical gear is easily assembled or dis-assembled. Main power leads are of superflexible, 500 Mcm rubber-covered cable with heavy solder lug terminations. All cables are carried to the drilling rig motors on expanded metal trays.

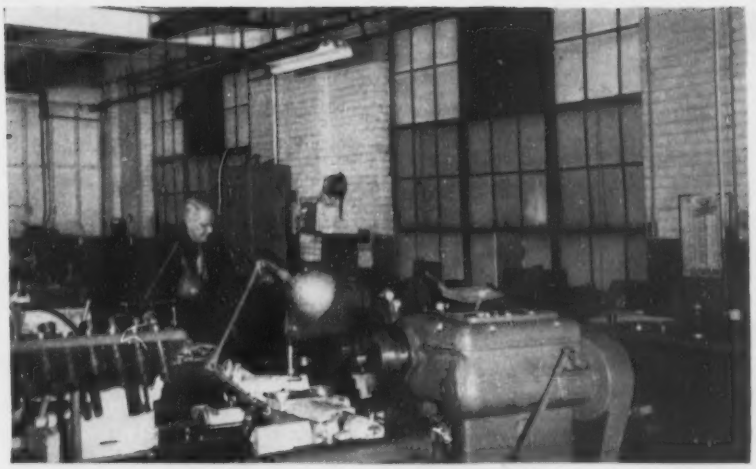
All control cables and main conductors can be disconnected by means of plugs and receptacles. Quick-break connectors are used at the points where the dolly walk and drilling structure break to facilitate transportation. Cables are transported in place when rig is moved. It is necessary only to make the various connections to establish the electrical circuits.

WEATHERPROOF CABINET houses d-c contactors, controls and meters. Polarized plugs, receptacles speed up of making the circuits.



POWER FOR DRILLING is handled by this 1,500-kva, 16.5/2.3-kv substation. Power is carried in 500 Mcm, rubber-covered cables





Electric Fans Aid Tool Making

Quick air changes are provided by four 30-in. electric fans, 1/5 hp each, in the Tool Making Department, Sharples Corp, Philadelphia, Pa., manufacturers of centrifugal machines for purification. Excess heat and odors caused by machine operations are removed. The fans help to keep working conditions ideal and employee morale high. A ventilating system for the Tin Plating Shop, powered by a 2¼-hp centrifugal blower gives a 1-minute air change and draws off fumes from plating and rinsing tanks. L. Albertson, Philadelphia Electric Co.

IEC Metal Sheath Heater Course Ready

To help utilities tap the ever-growing market for small low-temperature electric heating devices, a special metal sheath electric heater course is being readied by EEI's Industrial Electrification Council.

Scheduled for distribution and sale after Sept. 1, the course is designed for presentation to engineers in customer plants and for training utility and distributor salesmen.

Principal aim of the course, says the Council, is to show the industrial customer the wide variety of uses to which these heating devices can be put. It will help him to become more "electric minded" and pave the way for future larger installations by making him conscious of the advantages of electric heat. At the same time the company will gain through greater sales of heating equipment and added loads to its lines. It also will help relieve the company's sales force to tackle the larger jobs.

The course will consist of six 2-hr demonstration-type lectures. The first two will cover basic heating fundamentals with particular emphasis on advantages of electric heat. The remaining four lectures will be devoted to the solution of low-temperature heating problems. Training in how to select and apply proper heating equipment also will be stressed.

To be sold in a kit, the course will consist of the following items:

1. Two leader's guides.
2. Fifty students' textbooks.
3. One hundred and twenty overhead projector (vu-graph) slides.
4. Sixteen charts.
5. Sound-slide film with record.
6. Fourteen pieces of heating equipment for demonstrations.

Cost of each kit is $375 f.o.b. Extra copies of the student's textbooks will be available at $2 per copy. Address orders to The Industrial Electrification Council, Room 2650, 420 Lexington Ave., New York 17, N. Y.

Prevents Damage

Controlling conveyor belt movements with photoelectric tubes (electric eyes) at Philco's plant in Philadelphia, Pa., permits radio and TV sets to be transferred from one line to another at desired spacings and prevents collision and damage. L. Albertson, Philadelphia Electric Co.

INDUSTRIAL BRIEFS

Planned lighting of low ceiling basement area at Williamsport Narrow Fabrics Co, Narrow Braid Mill made this area suitable for manufacturing purposes. Production, sales and profits have increased. Previously, this company was turning down orders due to lack of production capacity—thinking that good lighting was not possible because of the low ceiling. Lighting load in this area is 6 kw. Harry Moore, Industrial Power Engineer, Pennsylvania Power & Light Co, Williamsport, Pa.

Electric pumping of crude oil at four stations on the Portland (Me)-Montreal 236-mile run of 12 and 18-in. pipe lines saves 2,000 round trip miles per tanker from Venezuela via the St. Lawrence River, icebound five months yearly. In 1953, 377 cargoes (over 53 million bbls) went to Montreal via the pipe line. At CMP's typical North Waterford pumping station (six synchronous 100% power-factor motor-driven units, total rating 3,000 hp) average 1953 billing demand was 1,900 kw and monthly use 1.1 million kwhr. Four new stations are coming to increase pipe line capacity from 158,000 to 190,000 bbls daily. Central Maine Power Co.

Heating glue at Bast Box Corp, Cressona, Pa., using strip heaters on individual machines provides constant temperature of 130 F, increases production, saves a considerable amount of glue and turns out a better product due to uniform temperature control. Formerly, glue was heated in master pot and distributed to each machine. This retarded production, because the glue cooled in transit between master pot and each machine. Vincent Smith, Industrial Representative, Pennsylvania Power & Light Co, Pottsville, Pa.

Water heating of three 120-gal oil-heated water tanks supplying yard office washrooms at The Philadelphia, Bethlehem and New England Railroad Co, Allentown, Pa., with 15 kw of electric heaters reduced cost of hot water during non-space heating season. Bill Zboyovsky, Industrial Power Engineer, Pennsylvania Power & Light Co, Allentown, Pa.

LIGHTS FLASH, load is added when switches are thrown on adequate wiring board. Indicator needle shows service entrance size needed

ASSEMBLY OF BOARD presented many problems to men in Florida P&L's meter shop. Board is constructed in a lightweight aluminum case

Is Your Wiring Adequate? This Board Will Tell You

LOWIS BOWERS, Florida Power & Light Co, Miami, Florida

An ingenious "wiring board" has been devised by two Florida Power & Light Co commercial engineers, to show simply and graphically the advantages of adequate wiring and a minimum service entrance of 100 amp. According to J. H. Keele, Florida P&L's sales promotion manager "as far as we know, this is the only board which is operated by the customer, who by doing so, sells himself."

The board cost about $600, including all parts and labor. However, it is impossible to calculate its value in promoting the installation of adequate wiring. Wherever it has been presented—at meetings of architects, electrical inspectors and wiring contractors, at home shows and in employee training meetings—the easy-to-understand board has been a big success.

Florida P&L's commercial men Fred Connell and N. H. Bollinger sought a simple way to demonstrate the need for, and benefits of, adequate wiring and finally came up with an idea. They visualized a board 30 by 40 in., made of aluminum painted gray. At the top, Reddy Kilowatt pointed out that adequate wiring is the key to happier Florida living. Three colored blocks marked 60 amp, 100 amp, 200 amp, designated size of service entrance.

As a small switch was flipped beside the names of 22 electric appliances, a lamp was lighted. This added to the existing load, shown on the board, the additional load required to operate the appliance. An indicator needle then swung over to show the size of service entrance needed.

The wiring code had to be interpreted to establish the relationship between appliances and main service requirements. Basis for the computation was a home with 1,000 sq ft with minimum equipment of electric range, refrigerator, water heater, one appliance and two lighting circuits.

Supplied with only a rough sketch, men in the Florida P&L Co meter shop encountered many problems before they transformed the idea into a finished product.

Behind the board, the men set up its mechanical heart with a neat arrangement of criss-crossed wires, two relays from a Motorola radio which had to be recalibrated to automatically connect and disconnect the three indicating lights above the meter, which established the overload of the services listed. Individual toggle switches operated the 22 lamps. An old Ohmmeter was converted so the scale read in milli-amps and 20 resistors were used, some in series.

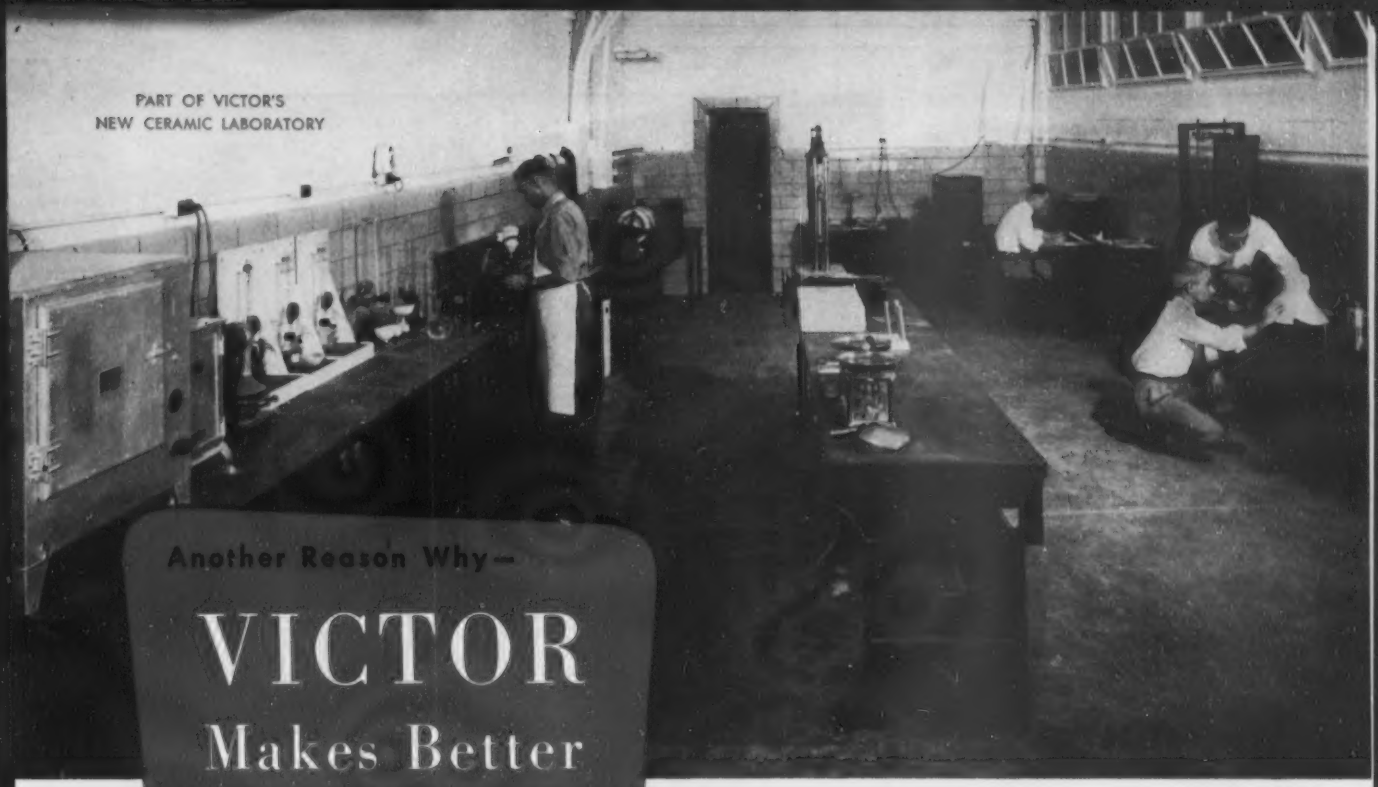
Converting from a-c to d-c was a major problem. A half wave selenium rectifier was not satisfactory so a full wave type was used.

Experiments made on the test board of the meter shop laboratory predetermined the set voltage of 115 v. Since voltage varied at different locations, a Variac was installed to keep the voltage constant.

For each of the various appliances listed, the resistors had to be calculated to simulate current flow in milli-amps instead of amps. Each light indicated a fixed load.

Other appliances were figured in the same way and instead of having a large load incorporated in the cabinet, it was planned on direct ratio equivalents, with the meter on the board indicating less than 100 milliamperes when the actual load in a home would be almost 200 amp. The greatest time was taken in experiments and securing and adapting necessary equipment. Actual assembly of the board required only three days' work by two men.

Several more of the "wiring salesmen" are planned. Buying parts directly from manufacturers and eliminating experiments is expected to cut the cost by one-third.



PART OF VICTOR'S
NEW CERAMIC LABORATORY

Another Reason Why—

VICTOR Makes Better Insulators

...WE CARRY ON

CONTINUOUS CERAMIC RESEARCH!

THE unequalled quality of VICTOR *Purified* Porcelain Insulators didn't just happen. It is the result of many years of research and experimentation in one of the industry's finest, most completely equipped ceramic laboratories. It is at VICTOR that many of the milestones in insulator progress such as infra-red drying, "black light" inspection and *Purified Porcelain* have originated. Because of VICTOR's continuing program of research, you can be sure that *IF* still better insulators can be made, they'll be VICTOR!

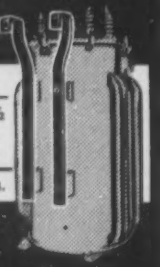
VICTOR NO. 924
25,000 LB. SUSPENSION
INSULATOR

Specify **VICTOR**
PURIFIED PORCELAIN INSULATORS!

VICTOR INSULATORS, INC., VICTOR, N. Y.

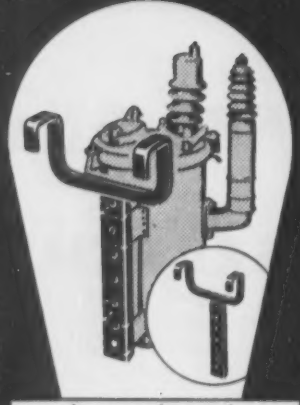
Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators
• Custom Designed Porcelain • Insulator Hardware

THIEL
TRANSFORMER HANGERS



MODEL	C-1	C-3
TRANSFORMER	75-100 KVA Single-Phase	75-112½ KVA Three-Phase
WEIGHT	46 lbs.	100 lbs.

Thiel Hangers, made according to NEMA specifications, are hot-dip galvanized to insure dependable service. In two styles, complete with galvanized bolts and nuts.



MODEL	1-PHASE	3-PHASE	WEIGHT
T-1	3-15 KVA	9 KVA	16¼ lbs.
T-2	25—37—50 KVA	15-45 KVA	37¼ lbs.

Hangers and Kickers *in Stock!*

HANGER KICKERS

MODEL K-1, which can be mounted in four different positions, is designed for use with T-1 Hanger shown above. MODEL K-2, for use with T-2 Hanger, has five mounting positions. Kickers, bolts and nuts are hot-dip galvanized.

Electrical Fasteners That Hold . . .

THIEL TOOL AND ENGINEERING CO.

1417 No. Market St. • St. Louis 6, Mo.

SALESMEN WERE TAUGHT to sell merits of electric cooking. They were paid special bonuses for sales. Premiums, low terms, wiring allowances also were used by dealers, utility

Kansas City Boosts Range Sales 97.6%

Kansas City Power & Light Company's cooperative sales activity with dealers and distributors resulted in the sale of 925 electric ranges in the eight week period ending June 13. This is an increase of 97.6% in electric range sales in Kansas City over the same period of 1953.

Features of the cooperative program were: a special bonus schedule for electric range salesmen, consisting of $1, $2, $3 and $4 for the first, second, third and fourth sales and $5 for the fifth and succeeding sales made during the drive; a customer premium of a set of copper-toned Hallite Wearever cooking utensils; terms as low as $10 down and 36 months to pay; wiring allowance by the utility of up to $45; and generous use of newspaper, TV and outdoor advertising.

A full-page advertisement was published each of eight successive Sundays in The Kansas City Star. Each page consisted of a four-column by 13-in. space promoting electric cooking and signed by the company plus tie-in dealer ads surrounding it.

Daily ads, 2 in. by 6 in. promoting the free set of cooking utensils also were used.

The company paid the salesmen's bonuses, provided the range wiring allowances and bore the cost of all advertising designed to promote generally the values and benefits of electric cooking.

Range distributors provided their dealers with the sets of aluminumware for use as premiums and stepped up their advertising allowances to dealers during the campaign period. Where new ranges were bought from local dealers and connected to the utility's lines, the company shared the cost of the premiums with the distributors. The entire premium plan was handled through the Electric Association of Kansas City.

Success of the campaign is attributed to a number of factors. First, there was a combined dealer, distributor and electric company effort. Second, there were extra bonus dollars for dealer salesmen plus a quality gift set of cooking utensils for purchasers. Third, utility advertising and all sales efforts were keyed to give prospects the plain facts about the advantages of electric cooking—every claim was backed up with factual reasons why electric cooking is better. Fourth—and the clincher—the philosophy of "when you have a better product, sell it on its merits" was instilled into every salesman.

Farm Lighting Promotion Announced by EEI

Spurred by a recent finding that farm lighting use is 50% behind that of urban residences, Edison Electric Institute has announced a "Be Modern—Light Up The Farm" promotion to get under way this fall.

The promotion, scheduled to run through September, October and November, will be aimed specifically at jacking up the lagging rural lighting market.

L. H. Hammond, chairman of EEI's Farm Sales Promotion Committee, said that a packet containing promotional pieces for the campaign already has been mailed to the industry. A farm lighting slide kit also will be made available.

MUD Promotes Ranges

Sacramento MUD will swing into an intensive electric range advertising campaign in August continuing through September. Advertising will capitalize on Sacramento Valley Electric League's spring range contest by using some of the reasons housewives gave for wanting an electric range.

Forty-four newspaper ads plus car cards will be used.

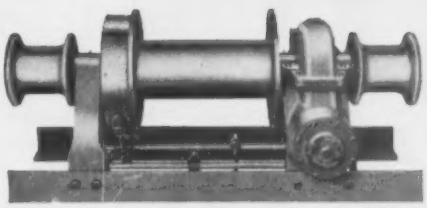
Kansas City Puts Controls On Air Conditioners

"Alarming demands" on the city's water supply by certain types of "water wasting" air conditioning systems has forced the Kansas City (Mo.) city council to adopt an ordinance prohibiting further installation of such units. It is believed to be the first such control ever to be passed by a city government.

The new ordinance, however, does not affect existing installations or refrigeration-type air conditioners and systems which recirculate the water. It stipulates that all new air conditioning installations must be equipped with evaporative condensers, cooling towers or other water conserving equipment. They must not use more than six gal of water an hour per ton of refrigeration under full capacity.

Still pending in Kansas City is another proposed ordinance which would increase water rates for nonconserving refrigeration and air conditioning units.

TULSA* WINCHES



The Model 23 Tulsa Winch is installed on the truck below. There are 27 other models in capacities from 6,500 to 80,000 lbs. for all makes and models of trucks and crawler tractors.

FOR HAULING...

Loading and unloading 3-ton cable reels is a simple task for this California trucking contractor. Working for a West Coast public utility, the driver easily, quickly and safely handles these reels of expensive copper cable. His Model 23 Tulsa Winch does the entire job.

Tulsa* Winch
TULSA, OKLAHOMA
DIVISION OF VICKERS INC.

*Reg. U. S. Pat. Off.

LETTERS TO THE EDITOR

Meet Chairman Stroud of Better Light Better Sight Bureau

H. A. STROUD

To the Editor:

We note with interest that Better Light Better Sight Bureau has an ally on your staff to help us in the task of finding men of high calibre in the industry to serve on the Bureau Committees. We certainly appreciate this help. I'm referring to the picture you ran in your July 19 issue over the item "Stroud Named Chairman of Better Light Bureau." I don't know who the man is in the picture, but he's a nice looking man and if he's willing, we'd be happy to have him join the Bureau.

The fact is, however, that we can't make him Chairman right away, as Art Stroud has just taken over that position. And besides—although the man in the picture is a fine looking fellow—we think Art is even handsomer. I'm enclosing a recent photo of Mr. Stroud and if you have room in a forthcoming issue, perhaps you can let your readers see what a nice looking Chairman we do have.

Edward A. Campbell
Manager

Better Light Better Sight Bureau
420 Lexington Ave.
New York 17, N. Y.

• The picture inadvertently used with the announcement of Mr. Stroud's appointment as chairman of the Better Light Better Sight Bureau was Leslie A. Johnson, new vice-president of Cornell Dubilier (see EW, Aug 9, p 169).—Editors

Straight Thinking Needed

To the Editor:

Congratulations on the hard hitting editorial which appeared in the July 12 issue of Electrical World with the heading "Give the Customer What He Wants".

This is what I view as meeting the problems head-on.

There is today great need for some straight thinking on the part of many utility managements who for one reason and another are contemplating the installation of load limiters, residential demand rates and other discouragements to the ultimate obtainment of the all-electric home.

G. T. Bogard
Manager, Utility Sales

General Electric Co
Appliance Park,
Louisville, Ky.

A Safety Idea

To the Editor:

After reading "War on Discarded Refrigerators" in Electrical World of June 14 it occurred to us that something could be done to minimize this tragic recurrence of loss of life of small children, and we feel that you could perhaps start the ball rolling.

We have in mind the possibility of building into the design of the refrigerator door a pressure panel on the inside of the door which would force the latch and cause the door to open if pressure is brought to bear on this panel from the inside. It does seem logical that a trapped child would struggle to free itself, and would probably push against the door thus contacting such a pressure panel. We do hope that this suggestion will be of some use and we feel that even partial success of this application in the saving of just a few small lives would be more than worth the additional cost involved.

W. B. Rhodes
Assistant Chief
Construction & Maintenance Dept

American Brake Shoe Co
Mahwah, N. J.

A Matter of Transposition

To the Editor:

I note that an error of considerable significance has been made in the last sentence of the last paragraph of the article "Mobile Meter Lab Provides Savings", in the July 26 issue.

The sentence in question should read: "It was found that work on resident "S" base meters furnishes better production figures than work on "A" base meters, other factors being equal."

The sentence as printed in the article is exactly the contrary, and I am quite sure will occasion considerable correspondence.

John A. Morris
Electrical Engineering Division

American Gas & Electric Service Corp
30 Church Street
New York 8, N. Y.

DOW

KURON

NEW DOW PRODUCT REDUCES VEGETATION CONTROL COSTS ALONG RIGHT-OF-WAYS

Used as a foliage spray... Kuron is tough on post oak, blackjack and other oak species

Kuron*, a new Dow product offered this season for industrial uses, is a low-volatile brush killer containing silvex**. It is highly effective as a foliage spray on post oak, blackjack oak, white oak and northern pin oak. Many other species of brush are controlled in the same application. Foliage sprays only are recommended at present.

Basal spraying with low-volatile Esteron® Brush Killer or Esteron 245 may be done any month in the year and should be planned to supplement your regular spraying program. Dow sales and technical men are available for consultation and assistance on your brush control problems. THE DOW CHEMICAL COMPANY, Agricultural Chemical Sales Department, Midland, Michigan. In Canada: Dow Chemical of Canada, Limited, Toronto, Canada.

**Kuron is the Dow trademark for its product containing 4 pounds per gallon of silvex.*
***Silvex is the common name for 2-(2,4,5-Trichlorophenoxy) propionic acid.*

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Setterstrom Nelpa President

R. C. SETTERSTROM

Northwest Electric Light & Power Association has elected R. C. Setterstrom of Montana Power Co as its new president. Setterstrom, an industrial development engineer, succeeds A. W. Trimble, a vice president of Pacific Power & Light Co.

Other New Officers . . . Nelpa also elected these officers: First vice president, Edward M. Naughton, president, Utah Power & Light Co; and second vice president, Ralph E. Gale, vice president, Idaho Power Co.

Appointment of H. C. Donaldson of Montana Power as treasurer has been announced by Setterstrom.

The newly elected president is an electrical engineer, having received his B.S. degree from Oregon State College in 1928. From that year until 1940 he was with Westinghouse Electric Corp, serving most of the time as sales engineer in Seattle, Wash., and Butte, Mont. Since 1940 he has been with Montana Power in Butte as industrial development engineer.

Brown Made a Vice President

George W. Brown, executive engineer of Wagner Electric Corp, St. Louis, has been elected a vice president of the company. In his new post Brown will have complete charge of the firm's Engineering and Research Divisions, both automotive and electrical. He will also serve as a member of Wagner's executive committee.

GEORGE W. BROWN

After joining Wagner Electric in 1926, Brown worked for ten years in the electrical engineering department where he specialized in the development, design, and application of fractional horsepower motors. He served as personnel director and industrial relations director prior to returning in 1952 to engineering as the company's executive engineer, with responsibility for general executive direction of automotive and electrical engineering and the metallurgical and chemical departments.

•

William H. Harbaugh and **John T. Bishop** have been appointed manager and assistant manager, respectively of the Kennett Square, Pa., plant of National Vulcanized Fibre Co, Wilmington, Del. With National since 1950, Harbaugh previously was manager of the Fibre Specialty Division. Bishop, who joined the company in 1936, formerly headed the Phenolite Division. Appointments of Harbaugh and Bishop were made in conjunction with recent administrative merger of those divisions, whose manufacturing operations are housed in the Kennett plant.

John E. Walters, acting general manager of Wallingford (Conn.) Borough Electric Works, has been made general manager. He was assistant general manager for 15 years prior to becoming acting general manager in September, 1953.

James Carmine Named President of Philco

Philco Corp, Philadelphia, has announced several top level changes. James H. Carmine, executive vice president for the past five years, was elected president to succeed William Balderston, who was named chairman. Balderston, with Philco 24 years, replaces James T. Buckley, who declined re-election as chairman after 42 years' service with the firm.

Carmine, who has served Philco for 31 years, is succeeded as executive vice president by John M. Otter, vice president of Consumer Product Divisions.

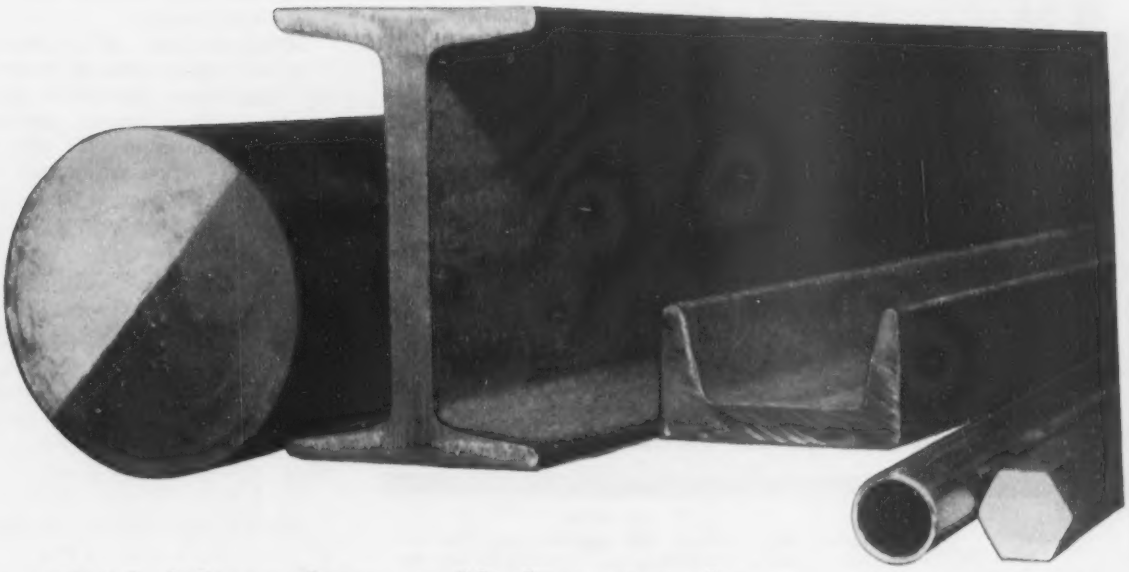
Philco also appointed these four officials to its board: Raymond B. George, vice president-merchandising; Frederick D. Ogilby, vice president and general manager, Television Division; Samuel N. Regenstrief, vice president-manufacturing, Appliance Division; and Raymond A. Rich, vice president and general manager, Appliance Division.

•

L. W. Coughlan, general auditor of Pacific Gas & Electric Co since 1951, has been elevated to assistant comptroller. **T. R. Salm** succeeds him as general auditor. Coughlan joined the utility in 1916. Salm came to PG&E through its consolidation with San Joaquin Light & Power Corp, which he joined as a clerk in 1921.

Dale C. Haynes has been named national sales representative by Westinghouse Electric Corp's Electric Ap-

call Ryerson for steel carbon, alloy, stainless



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This new M&M Brush Grinder rapidly converts 7 truckloads of brush into one truckload of chips.

Save on labor costs . . . truck operating costs. One man feeds brush or branches up to 6" in diameter into the Brush Grinder where they are chewed into small uniform wood chips and automatically blown into a truck or spread on the ground. The new M & M Brush Grinder is a portable unit with its own power plant. It hitches to jeep, car or truck for transportation right to the job. Safe easy operation with all moving parts fully enclosed. Nearly 100 years of experience in building fine grinding equipment is your assurance of long dependable service from an M & M Brush Grinder.

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WRITE FOR ILLUSTRATED FOLDER TODAY

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MITTS & MERRILL 1002 S. WATER ST., SAGINAW, MICHIGAN

pliance Division, Mansfield, Ohio. Haynes will serve as sales department representative at the firm's refrigerator-freezer plant in Columbus, Ohio. Previous to accepting his new position, he was a staff assistant in the national accounts department.

GE Makes 3 Changes in Marketing Section

General Electric Co has made three appointments in the marketing section of the Large Steam Turbine-Generator Department.

Charles E. Kilbourne has been named manager-product planning and market research; Charles S. McBride, manager-advertising and sales promotion; and John T. Peters, manager-marketing administration and personnel development.

Kilbourne joined the company in 1929 after taking advanced studies at the Massachusets Institute of Technology. McBride became associated with the company in 1917 when he joined the Turbine Engineering Department. Peters came to GE in 1942 when he entered the company's engineering training program.

•

R. J. Beamish, Jr, has resigned as manager of Tennessee Valley Authority's Western District to enter private business. He has been manager of the district, with headquarters at Jackson, Tenn., for the past five years.

Kathleen McTigue has been appointed administrative assistant to Pres A. F. Franz of Colorado Fuel & Iron Corp, New York. Miss McTigue, who joined the corporation in 1945, has been serving in an executive-administrative capacity for the past four years.

Clyde F. Boland has succeeded Edward Wimberly as chairman of the South Carolina Public Service Commission.

William E. Wood has retired as executive vice president of Virginia Electric & Power Co. His retirement ends a 47-year utility career which was started in 1907 when he became affiliated with Stone & Webster in Boston, Mass. After serving with several properties under Stone & Webster management, he was elected president of

Virginia Electric & Power Co in 1927. Two years later he was appointed vice president of the parent company, Engineers Public Service, filling that post until 1941 when he became president of Virginia Public Service Co. He was made vice president of Vepco when it merged with latter firm in 1944.

Named to Executive Post

Ray L. Hamilton, veteran Bechtel Corp pipeline engineer, has been named vice president of the corporation. He was elected vice president of Bechtel International Corp and Canadian Bechtel Ltd in December, 1953. Hamilton joined Bechtel in 1940 after 13 years as a gas and pipeline engineer for Standard Oil Co of Calif. Previously he was an engineer for Standard Oil Co of Indiana and Associated Oil. He holds degrees in chemical engineering and mechanical engineering from Stanford University.

•

Ernest A. Bamman, formerly supervising hearing examiner, has been named director of the Utilities Division of the New York Public Service Commission to replace **Malcolm F. Orton,** retired.

Robert A. Baker has been advanced from assistant to mechanical engineer to power project engineer in the electric engineering department of Public Service Electric & Gas Co. In another department changes, **Lee W. Lemon** was elevated from assistant to mechanical engineer to mechanical engineer. These appointments were made because of the recent death of Herman Weisberg, former mechanical engineer (EW, July 19, p 43).

Theodore F. Eichstaedt, formerly manager of the machinery and tool department at the Chicago plant of Joseph T. Ryerson & Son, Inc, has been appointed assistant manager of the firm's Machinery and Tool Division.

Assigned to New Post

Election of Robert A. Bartlett as first executive vice president has been announced by F. A. Bartlett Tree Expert Co, Stamford, Conn. With the

NOW-A Better Tap Connector THAT'S EASIER TO USE YET COSTS LESS!

the New **IDEAL Tap Connector**

The all-new IDEAL Tap Connector is the first big improvement in tap connectors in many years.

Its unique design not only gives *greater* mechanical strength — more contact area and more pressure, but also keeps the connector under constant spring tension. As a result contacts are better, wires can't work loose and "burnouts" are practically eliminated.

Easier to Stock!

ONLY THREE SIZES are needed for all combinations from two No.1 wires to one No.10 and one No. 12 or one No. 8 and one No. 14. Connectors are available *without* spacer bars for copper-to-copper or aluminum-to-aluminum, *with* spacer bars for copper-to-aluminum, copper-to-steel or aluminum-to-steel.

Easier to Use!

JUST ONE UNIT!

No Parts to come loose

Costs Less!

The IDEAL Tap Connector is lower in price than other connectors for practically every combination.

Sold Through Leading Distributors

Ask To See It!

Or mail coupon for full data—how you can save money and have better tap connections!

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1021 Park Avenue, Sycamore, Illinois
Please send catalog data on IDEAL Tap Connectors

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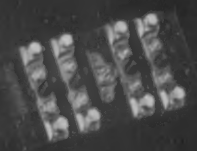
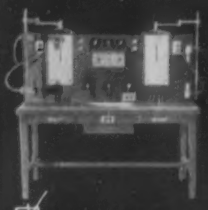
SWITCHES

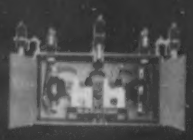


BLOCKS



TABLES

SOCKET EQUIPMENT



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U.S. Patent No. 2,336,965.

Derrick raised by simply engaging the winch.

Vertical position—winch rotation reversed.

Derrick is locked in operating position.

company since 1937, Bartlett has served as vice president for the past 14 years. Bartlett is the son of Dr F. A. Bartlett, founder of the Bartlett company and its present board chairman.

A. Augustus Low has retired as vice president of industrial relations for Consolidated Edison Co of New York, Inc. Low, who was named to the vice presidency in 1937, joined the Con Edison system in 1936 as executive vice president of Brooklyn Edison Co. He entered the utility field by organizing the Old Forge (N. Y.) Electric Co in 1928. He joined Utica Gas & Electric Co in 1931 as executive vice president, later becoming president.

Herbert L. Goodridge has been appointed chief relay engineer of the New England Electric System with headquarters at Boston. He succeeds **Clarence F. Powers,** who has retired after 40 years' service with the organization.

Frank R. Jamison, public relations counsellor for Public Service Co of Colorado, has retired. Jamison had been director of advertising and publicity for 31 years before becoming counsellor two years ago.

E. R. Sliger has been assigned to the newly created post of assistant general sales manager of Westinghouse Electric Corp's Electronic Tube Division. Sliger, who began with Westinghouse in 1945, has been with the division since 1952 as a member of the vice president's staff in charge of market research.

J. C. Duckworth, the chief engineer of Ferranti Laboratories at Wythenshawe, near Manchester, England, has been chosen by the British Electricity Authority to superintend design, construction, and operation of its nuclear power station.

Earle E. Curtis, district manager for Kentucky Utilities Co at Mount Sterling, Ky., for 23 years, has retired. **Stuart Brooks** replaces Curtis, who will remain with the company as an adviser.

Roy F. Miller, vice president and treasurer of Northern States Power Co of Wisconsin, has moved up from the vice chairmanship to the chairmanship of the Accounting Section

of the Wisconsin Utilities Association.

Fred O. Harbrecht, assistant to the vice president and controller of the Wisconsin Electric Power Co, has been elected vice-chairman, succeeding Miller.

Henry C. Rice, sales director of Southern California Edison Co since 1950, has retired after 37 years with the utility. Active in industry organizations, he has served as chairman of the business development section of the Pacific Coast Electrical Association.

W. D. Pierson, Jr, has joined the Marketing Department of Roller-Smith Corp as manager, product planning. He comes to the Bethlehem, Pa., organization after many years of experience in a similar capacity with General Electric Co.

Elevated by RCA

Radio Corp of America has announced the election of Robert A. Seidel as executive vice president, consumer products. Seidel, who joined RCA as a vice president in 1949, formerly was vice president and comptroller of the W. T. Grant Co.

OBITUARY

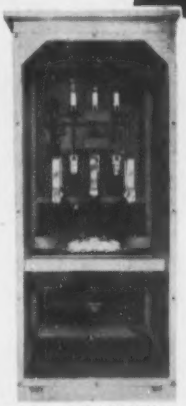
William L. Diehl, 71, retired vice president of Westchester Lighting Co, now part of Consolidated Edison Co of New York, Inc, died July 31 in White Plains, N. Y. Associated with Westchester Lighting and a predecessor company, Central Union Gas Co, for more than 40 years, he was secretary prior to assuming the vice presidency in 1937. He retired in 1947. He was also a former secretary of Yonkers Electric Light & Power Co and Bronx Gas & Electric Co, which have been merged with Con Edison.

Rufus E. Park, 56, manager of the Verdigris Valley Electric Cooperative, died in Collinsville, Okla., recently.

Reford Bond, chairman of the Oklahoma Corporation Commission, died recently.

CUT COSTS

BROWN BOVERI LOAD BREAK SWITCHES



Brown-Boveri RB-20K Load Break Switches installed in cubicle, 94" x 40" x 60", rated 400 amperes, 15 KV. Switch permits full load interruption of primary of 1600 KVA 3-phase 13.8 KV to 480 Volt power transformer.

no contact replacement for 500 full current interruptions

THESE load break switches are designed with higher efficiency and lower maintenance costs in mind. The switching movement of each switch generates its own compressed air which instantly extinguishes the arc and prevents contact scorching. This operating principle makes possible 500 FULL-CURRENT INTERRUPTIONS WITH NO CONTACT REPLACEMENT or MAINTENANCE (no fire, no explosion, no fumes either). They can be installed easily in a minimum of time.

The High Breaking Capacity and High Operating Speed make these load break switches ideal for sub-station and branch-line service.

Brown Boveri Load Break Switches are available for 7.5 kV (interrupting 10,000 kVA) and 15 kV (interrupting 15,000 kVA) — for indoor service. They can be supplied in a steel housing for outdoor use.

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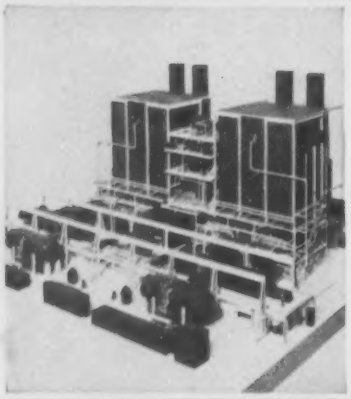

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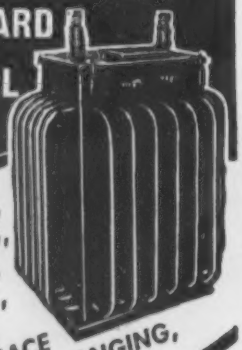

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Hoover Dam Power Users Cut Firm Commitments

Because of low runoff and short water supply in Lake Mead, groups allotted power from Hoover Dam have agreed to cut their firm power commitment to 4,181,000,000 kwhr, lowest that has ever been set.

Los Angeles Department of Water and Power, largest user of Hoover Dam power, estimates that it will cost about $570,000 to make up some 200 million kwhr by steam generation during the period. The municipal utility has been getting around 30% of its power from Hoover.

Southern California Edison Co, which has been getting about 10% of its power from Hoover, will have to make up upwards of 121 million kwhr by steam generation, at and as yet unestimated cost.

California Electric Power Co, Riverside, Calif., estimates roughly that it will cost $30,000 to make up 14 million kwhr by steam generation. Calelectric has been buying about 18% of its power from Hoover.

All three utilities said that the Hoover curtailment could be made up without creating a power shortage within their systems.

BPA Is Reducing Staff by 199 in Reorganization

Employment termination notices are being issued 199 Bonneville Power Administration workers this month as the agency speeds up reorganization of personnel and department functions as recommended by a special administrative survey team which directed cutback of staff to a total of 2,100 by next June. Personnel affected by the 30 day notices involve 129 in the Portland-Vancouver headquarters area and 70 in field offices in Washington, Oregon, and northern Idaho, and Washington, D. C.

The latest release list includes 28 professional engineers. Others include 38 in system design, construction and supply branches, 20 in administrative and clerical work, and 61 general construction workers and 52 in transportation, principally drivers, helpers and mechanics.

Bonneville's announcement, which added that about half the positions being abolished, are filled with temporary employees, noted that a shift of agency construction policy—less force work and more by private contractor—will make it possible to carry out the reduction without disruption or curtailing of any essential transmission agency services.

Bonneville Administrator William A. Pearl has assigned Howard B. Stawn as a placement officer for the purpose of assisting professional staff members in connecting with private industry positions which are being made available through the office. Pearl said it was BPA's intention to cooperate fully in such placement.

Reclamation to Establish New Office in Colorado

Bureau of Reclamation will establish a South Platte River Project office at Loveland, Colo., by 1955. L. N. McClellan, assistant reclamation commissioner, said 155 persons will be employed in the office which will supervise the Colorado-Big Thompson project construction and operation.

The new office will also supervise planning for the South Platte Basin and other projects in the area. A regional power operations office will be established at Loveland also. This office will provide technical supervision for the bureau's Region 7, the Upper Platte River and Colorado-Big Thompson power and engineering programs.

McClellan said the bureau had dropped plans to merge the Casper, Wyo., Reclamation office with the new Loveland headquarters. He said the office at Casper will be retained to supervise bureau offices in that area. It will be named the North Platte Project office.

Stone & Webster to Design Synchrotron Structure

Stone & Webster Engineering Corp has been selected by Brookhaven National Laboratory as architect-engineer for the building and supporting facilities of the 25-billion-electron-volt proton synchrotron the laboratory will construct at Upton, N. Y.

Approval to design the ultra-high-energy particle accelerator was given to Brookhaven, one of the Atomic Energy Commission's national laboratories, by the AEC in January of

this year. Project will cost $20 million with $5 million of this amount set aside for construction of the structures.

The synchrotron will be housed in a doughnut-shaped tunnel approximately 20 ft in cross section. The hole in the middle will be over 800 ft across.

Ice Harbor Dam Prospect Not Encouraging to PUD's

Construction of Ice Harbor Dam on the lower Snake River is not an encouraging prospect for public utility districts, declared Owen Hurd, manager of the Benton County PUD at Prosser, Wash.

"The delays brought on by fishing interests who oppose multipurpose dams on the lower Snake, and the present lack of upstream storage on the Snake and Clearwater Rivers make the picture anything but encouraging," Hurd stated. He pointed out, however, that the Benton and Franklin county PUD's will continue their study of the project.

"Ice Harbor is desperately needed," according to Hurd. It would be the first of four on the lower Snake allowing river navigation as far upstream as Lewiston, Idaho—a dream of decades among rivermen in the Pacific Northwest.

Hurd said the general conclusion of the PUD's is that, to build Ice Harbor Dam with federal assistance, the utility districts would have to be assured "of the complete backing of the federal government."

Retiring Corps Engineer Raps Report on Columbia

The Army's so-called 308 report for development of the Columbia River basin contains "four basic flaws" and is an "obsolescent document," in the opinion of Col Fremont S. Tandy, who retired Aug. 1 as district engineer for the Corps of Engineers at Walla Walla.

In a statement he said was issued as a professional engineer, Col Tandy made these points:

Comprehensive development of the Columbia basin can best be accomplished under present laws with two changes: state governments should be

(*Continued on page* 205)

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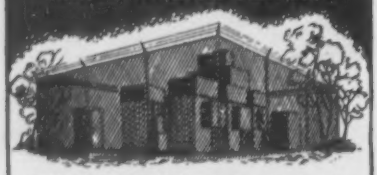

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Security Sales

(*Continued from page* 101)

71 electric companies whose June earnings have been published at this writing, reveals that, on the average, earnings per common share for the 12 months to June 30, 1954 were barely 1% above earnings for the same period ended June 30, 1953.

Dividend increases have failed to keep pace with last year's declarations. Only 20 electric companies raised their dividend rate in the first half of 1954 compared with 30 in the first six months of 1953, out of some 133 companies reviewed.

Eugene, Ore., Consumers Get New Rate Schedule

Eugene, Ore., Water & Electric Board has put into effect a new electricity rate schedule based on a demand meter method of figuring charges.

The new rates will affect only about 1,250 customers—mainly those who formerly paid a penalty rate because they use large amounts of electricity for heating or appliances. They will get reductions under the new schedule.

The board has ordered 2,300 devices to be placed on meters to implement the new system. The first batch will be installed on commercial and industrial meters, and more will be ordered for residential meters. The change-over is expected to be completed in a year.

Nebraska Court Hears Power District Dispute

A suit brought by the Custer County Public Power District to stop the Loup River Public Power District from issuing $17.6 million in bonds to build a steam plant near Beatrice, Neb., has been heard in the District Court at Columbus, Neb., with Judge H. Emerson Kokjer of Wahoo presiding.

In attacking the validity of the bonds, the Custer district contended that the 4.06% rate at which the bonds were sold exceeds the 4% interest rate fixed in the notice of sales. It was further contended that the budget board, an organization of representatives of customers of the Loup district whose approval was necessary, did not approve the transaction at a meeting on March 30.

The Loup district and other defendants urged the court to issue a declaratory judgment upholding the validity of the Series D bonds issued to finance the plant.

Loup argued that the interest rate is 4% and, therefore, legal and that the additional 0.6% is a discount at which the bonds were being sold and not part of the interest rate.

Loup further contended that the budget board approved the sale after being so instructed by a vote of the representatives of Loup wholesale customers held March 19 in Lincoln.

The Custer district and other plaintiffs want the court to clarify the rights of public power district customers and others involved in the current steam generating plant controversy between the Consumers Public Power District and the Nebraska Public Power System.

Plant Transferred

Mabel W. Keller, executrix of the estate of Martin W. Keller, has received New York State Public Service Commission approval to transfer the plant of Kenwood Electric Light Co to Sherrill-Kenwood Power & Light Co, Inc, for $1.00. The PSC has also authorized Sherrill-Kenwood P&L to issue 326 shares of $100 par value common stock and to sell them to Oneida, Ltd, in exchange for a $32,000 note held by the latter.

FINANCIAL BRIEFS

Long Island Lighting Co common stockholders have subscribed for 675,879 shares of 690,062 offered on a 1-for-8 basis at $19.75 a share. Balance 14,183 shares quickly sold by a underwriting group headed by Blyth & Co. Employees subscribed for 31,142 of the 64,685 shares which were offered them in the maximum of 200 shares each, also at $19.75.

Cleveland, Ohio, plans to sell $5 million electric revenue bonds . . . **Vineland, N. J.,** will sell $3.5 million electric bonds on Sept. 28.

Army Report Criticized

(*Continued from page* 203)

given more voice in the planning of projects, and a national board of engineering review should be established to advise Congress and the President on water resources development.

Controversy over Hells Canyon Dam and Federal Power Commission hearings on it are not necessary, in the colonel's opinion, because no comprehensive engineering study has been made to determine which are the best Snake River damsites.

Flood control storage can best be provided as close to the source of floodwaters as possible, specifically on the upper reaches of the Snake and its tributaries—near the snowpacks responsible for the floods.

John Day Dam should be the next project undertaken to keep in logical sequence the development program on the Columbia. This dam is necessary to provide slack water navigation.

Ice Harbor Dam should follow, and if private companies do not undertake the Clearwater Dams (Penny Cliffs and Bruces Eddy) these should be built by the government before going on with the remaining three lower Snake River dams.

In his opinion, Colonel Tandy said Army engineers made "a serious mistake" in proposing extensive flood control facilities for the John Day project.

"Flood control envisioned at John Day can be obtained upstream at less cost, and the upstream storage will provide additional power and irrigation benefits. It will also cut the cost of John Day by approximately $100 million."

As for the 308 report, Colonel Tandy said its "engineering features are basically sound," but the report failed to take into account storage on the Canadian sections of the Columbia River; failed to project any storage of consequence on the Clearwater; and failed to produce a comprehensive program for developing water resources on the Snake above Weiser, Idaho.

League Changes Name

North Central Electrical League, Inc, is the new name of North Central Electrical Industries, Inc. Headquarters for the organization is 209 Foshay Tower, Minneapolis, Minn.

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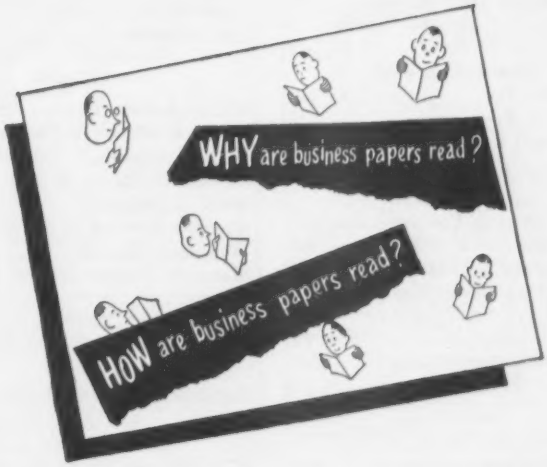

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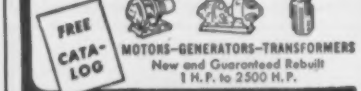

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35	Westg.	SK-150	350/100
30	Cr. Wh.	CCM-504	450
30/40	G. E.	CD-115	800/1500
25	Westg.	SK-1006	1100
25	G. E.	RC-32	800
25	A. C.	E-130	775
25	Westg.	SK-133	575
20	Star	SB-10	1750
20	G. E.	CD-65	1150
20	Westg.	SK-1106	750
15	Westg.	SK-103	400/600
10/15	Rel.	185T	400/1600

WE'LL SELL, BUY OR TRADE
PHONE CANAL 6-2900

CHICAGO *Electric Co.*

1324 W. CERMAK ROAD
CHICAGO 8, ILL.

TRANSFORMER—OUTDOOR

NEW 1948—NEVER USED

3750 KVA 3 Ph. 60 Cyc. 38030/65865Y—13800 V. 3-5% Taps, Penna. OISC. inert gas. Oil Seal Additional Radiators will increase capacity 25%

NORTHERN STATES POWER COMPANY
1600 Chestnut Ave. No. Minneapolis 3, Minn.

DIESEL POWER

IMMEDIATE SHIPMENT
• PURCHASE OR RENTAL
UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS

A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1180	Worthington	SEH-8	1685	360	400	Ingersoll-Rand	8-8	600	720
1136	Fairbanks Morse	38D	1600	720	350	Baldwin	VO-6	510	450
1100	General Motors	16-278A	1600	720	320	Enterprise	DSG-6	560	450
1000	General Motors	16-567B	1440	720	300	General Motors	8-268A	450	1200
750	General Motors	12-567	1060	720	200	General Motors	8-268A	350	900
700	Worthington	EE-8	1000	327	150	Worthington	CC-4	225	450
500	General Motors	8-278A	750	720	150	Ingersoll-Rand	8-4	225	600
500	General Motors	8-567	720	720	150	Buckeye	80	240	600
500	Alco	6-12jx13T	750	600	100	General Motors	3-268A	150	1200
400	Sterling	VDS-8	600	1200	60	General Motors	6-71	90	1200

A. G. SCHOONMAKER COMPANY, INC.
DIESEL DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

1606 53rd St. NORTH BERGEN, N. J. N.Y.C. Tel. LOngacre 5-3227 N. J. Tel. UNion 3-7800

TRANSFORMERS

1— 750 KVA G.E., 3 Ph., 4150V. 120/240V.
2— 750 KVA G.E., 1 Ph., 4600V. 115/230
2— 400 KVA Pitts., 1 Ph., 2400/4800/4150/2400—240/480V.
1— 750 KVA—Auto 3/4150—2400
2— 300 KVA G.E., 1 Ph., 13200V. 220/440V.
1— 200 KVA G.E., 3 Ph., 2400-220 sec.
3— 200 KVA G.E., 1 Ph., 13200V. 440V.
1— 200 KVA G.E., 3 Ph., 4150V., 3 Ph. 2400V. Auto.

SYNCHRONOUS MOTORS

1— 300 H.P., Elec. Mach., 720 RPM. 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G.E., 1800 RPM, 220V, 3/60.
2— 150 H.P., Al. Chal. 360 RPM, 440V, 3/60.

MOTOR GENERATOR SETS

1—1000 KW Whse., 600 V. 720 RPM. 4150 syn.
1—1000 KW G.E., 600 V. 514 RPM. 4000 Syn.
1—1000 KW Whse., 275 V. 720 RPM. 4000 Syn.
1— 200 KW Whse., 250 V., 900 RPM. 4000V. Syn.
1— 150 KW G.E., 126/250V. 1200 RPM. 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM. 2300 V. Syn.

SLIP RING MOTORS

2— 500 H.P., G.E., M 1200 RPM 2400V.
1— 400 H.P., West. CW, 450 RPM, 550V.
1— 250 H.P., West., CW, 600 RPM, 440V.
1— 200 H.P., West., CW, 600 RPM, 440V.
3— 150 H.P., Al. Ch. 1800 RPM, 2300V., 3PH, 60 Cy.

Large Stock of A.C. and D.C. Equipment

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
1	10000	A. C.	66000—33000, 3 ph.
3	3125	Mol.	66000—24000
4	2500	Mol.	66000—13800
6	1250	Mol.	66000—2400
4	500	West.	69000—6900
3	400	G. E.	66000/33000—2300/4160
3	333	Stand.	69000/34500—7200/12470 Y
3	200	Pitts.	66000—2300
3	1500	Wag.	44000—6900
3	1250	A. C.	44000/11500—460
4	150	West.	44000/33000—2300/6900
3	75	West.	44000—7200/12470 Y
3	5000	G. E.	38100/66000—6600
1	3750	Penna.	38030/65865 Y—13800, 3 ph.
3	3333	G. E.	38100/66000—33000
4	3125	Mol.	39900/66000 Y—26600/46000 Y
6	2000	Mol.	38100/66000—13800
4	4500	G. E.	36000—13300—2400
2	15000	West.	33000—2400/4160 Y, 3 ph.
1	5000	West.	34500—13750, 3 ph.
3	3333	G. E.	33000/11000—2400/7200
4	333	G. E.	34500—13800/23900 Y
3	333	G. E.	33000—7200/12470 Y
3	200	A. C.	34500—2400/7200/12470 Y
3	75	Wag.	33000—240/480
3	1250	G. E.	26400/13200—2400
3	1500	A. C.	25400/44000 Y—6900/13800
3	100	G. E.	22000—7200/12470 Y
3	50	G. E.	22000—2300
3	667	G. E.	13800—2300
1	600	Stand.	13200—2300, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
1	333	G. E.	13200—2300
6	200	G. E.	13200—230/460
3	1000	A. C.	6900/11950 Y—480
3	100	A. C.	6900—2300
3	37½	G. E.	69000—230/460
4	150	G. E.	4800/2400—240/120
2	100	G. E.	4800/2400—240/480
1	3000	G. E.	4160—480/277 PYRANOL
3	333	G. E.	2400/4160 Y—240/480
3	250	G. E.	2300/4000 Y—115/230
3	200	West.	2400—240/480
3	150	West.	2400—230/115
1	100	G. E.	2300—575 3 ph.
6	50	West.	2400—114/228 DRY TYPE

ALSO— FREQUENCY CHANGERS
MOTOR GENERATOR SETS
SYNCH. CONDENSERS
OIL CIRCUIT BREAKERS
FEEDER REGULATORS, etc.

BREW, WOLTMAN & CO., INC.
52 Church St. New York 7, N. Y.

RE-NU-BUILT
GUARANTEED

ELECTRIC POWER EQUIPMENT

MOTOR GENERATOR SETS

3 ph., 60 cy.

Qu.	KW	Make	Speed	DC Volts	DC Volts
1	3000	GE.	514	600	4000/13200
2	2000/2400	G.E.	450	250/300	2300/4800
2	2000	G.E.	514	600	6600/13200
1	2000	G.E.	600	600 25 cy.	11000
2	2000	G.E.	450	600	2300/4600
1	1500	C.W.	514	115	4000/13800
1	1500	G.E.	720	600	13200
1	1000	G.E.	900	260	4100/6900
2	1000	Whse.	900	600	2300/4150
3	1000	G.E.	720	600	2300/4600
1	750	Whse.	900	275	2300/4150
1	500	Whse	1200	125/250	2300
1	500	Whse.	900	250	440
1	500	G.E.	720	125	2300

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	4000	G.E.	Condensing—425 lbs—750° F.T.T.—Surface Condenser 3/60/2300-4000 v with exciter
1	1000	G.E.	Non-Cond—190 lbs-2400-3-60
1	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter
1	300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B. P., 480-3-60

FREQUENCY CHANGERS

Qu.	Kva	Make	Cycles	Voltages
1	13200	Whse.	60/25	13200 x 13200
1	3750	G.E.	60/25	4150/2400 x 2400/4150
1	3125	G.E.	25/60	4150/2400 x 2400/4150
2	2500	G.E.	25/62½	2200 x 4160
1	1250	G.E.	25/58.3	4400 x 2300
1	625	A.C.	25/60	11000 x 2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
1	5000	Whse	OISC	3	33000x26400/13200
1	2500	Whse.	OISC	3	26400/13200 x 480
3	2000	G.E.	HVDDJ	1	66000 x 13800
1	1500	G.E.	HT	3	13200 x 2300
3	1250	G.E.	HVDDJ		6600/550
3	1000	G.E.	HVDDJ	1	2200/480

BELYEA COMPANY, INC.
51 Howell Street, Jersey City 6, N. J.

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CAN GROW

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ROCKBESTOS AVC®

(N.E.C. TYPE AVA)

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When you're building your plant, that's the time to install Rockbestos A.V.C. and you will automatically add 30 to 50% more current capacity for future needs.

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Standard Rockbestos A.V.C. (N.E.C. types AVA, AVB, etc.) are available from stock for immediate shipment. Call or write nearest branch office.

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VAULT BEFORE

VAULT AFTER

Cuts space needs in half!

New Vault-Type Power Unit Ideal for Shopping Centers

ALLIS-CHALMERS NEW vault-type power unit provides three or four standard distribution transformer core and coil assemblies plus metering transformers in a single, submersible-type tank. The units are so compact that a complete vault-type power unit takes only half the space of a bank of three single-phase distribution transformers.

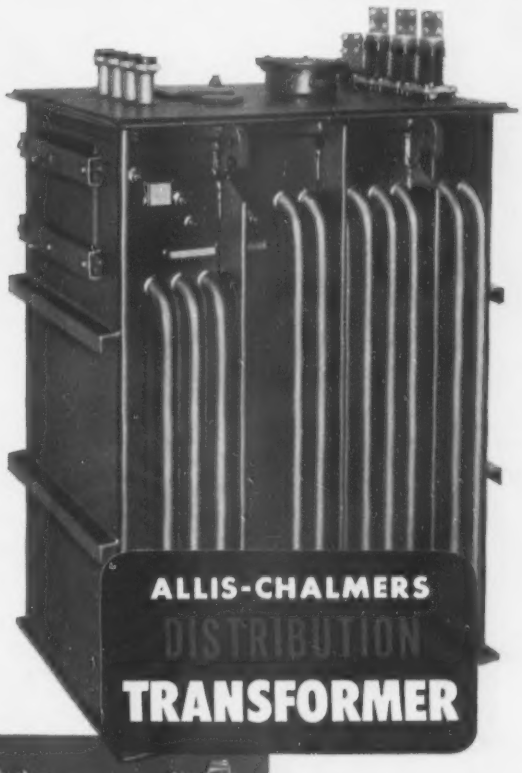
The new unit can be designed to supply three-phase power or three-phase power and single-phase lighting loads. It is the ideal answer to the space problem in areas like schools, hospitals, large apartment houses or where increased use of air conditioning or other large appliances is causing loads to grow fast.

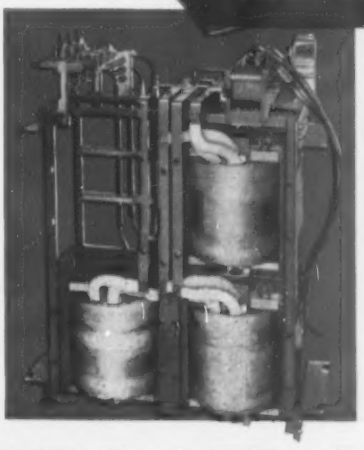
Simplified Installation

Allis-Chalmers vault-type power units can be installed either underground or in buildings. Core and coil assemblies are internally connected at the factory and leads are terminated at the cover. This reduces installation time and expense by eliminating primary and secondary bus work.

Get complete information on the space-saving advantages of Allis-Chalmers new vault-type power units. Consult the A-C office nearest you or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4426



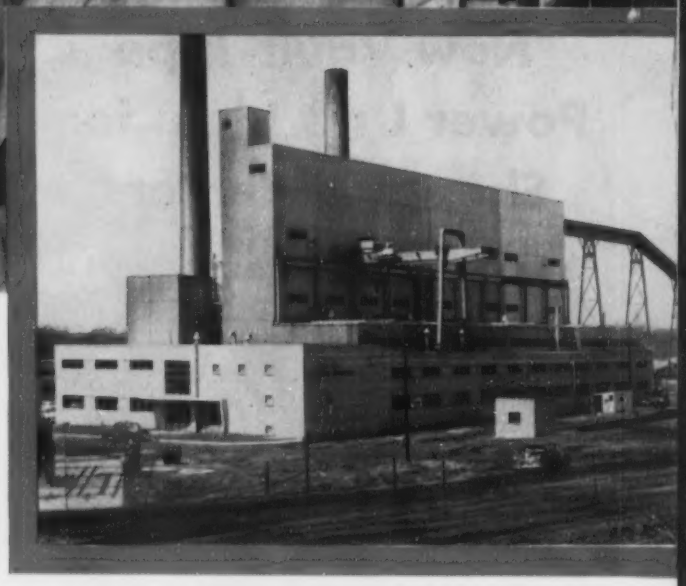


TEMPORARY CLAMPS seal HV access panel until installation. After final system connections are made, panel is welded into position. All other covers are weld-sealed. Special paint and compound protect case. Space is provided for an additional core and coil assembly to change a three-phase unit into a combination single-/three-phase unit.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

On-the-spot help and advice is part of the job for every Standard Oil lubrication specialist. Here Chief Operator G. C. Barlow and Standard's R. R. Spargo examine color and clarity of NONPAREIL during regular periodic check-up.



"We picked the only oil with a turbine life-time guarantee!"

NONPAREIL
TRADE MARK
Turbine Oil

STANDARD

■ "When our new Power Plant was planned, your turbine oil guarantee impressed all concerned at the Corn Belt Power Cooperative at Humboldt, Iowa," says Chief Operator G. C. Barlow. "Only Standard offered a guarantee on turbine oil for the life of the turbine—so we chose Standard's NONPAREIL Turbine Oil—and we've been completely satisfied since."

Specifically, Standard guarantees that the acidity of NONPAREIL Turbine Oil will never exceed a neutralization number of 0.15 KOH/gm. This means an absence of sludge and deposits in governors and filters. The whole system stays clean. The oil never needs to be removed for treating or cleaning.

Corn Belt's first three turbines were initially filled with NONPAREIL Turbine Oil in 1950 and 1951. Since then periodic checks have shown that the neutralization number has never exceeded 0.04 KOH/gm. The turbines have operated perfectly without *any* cleaning or changing of oil. Naturally, when a fourth turbine was recently added it too was filled with NONPAREIL.

NONPAREIL has been making records like this in turbines large and small for more than 25 years. For this kind of guaranteed superior lubrication in *your* plant's turbines—new or old—fill with NONPAREIL. A Standard Oil lubrication specialist will be happy to show you the facts and data on NONPAREIL's history in installations similar to yours. Call your nearest Standard Oil office or write: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (*Indiana*)